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SNOQUALMIE RIVER NPDES PERMITTED DISCHARGERS JULY - SEPTEMBER 1989 INSPECTIONS

by
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ABSTRACT

In support of Ecology's Snoqualmie River Low Flow Water Quality Assessment project (Joy, in prep), data was collected from the four NPDES permitted discharges in the study area. The four included three municipal dischargers (North Bend, Snoqualmie, and Duvall) and one industrial discharger (the Weyerhaeuser Snoqualmie Log Pond). Four sampling visits, including one Class II Inspection at each of the municipal dischargers, were made at each discharger between late July and late September 1989. The three municipal dischargers had difficulty meeting all NPDES permit limits in varying degrees. The industrial discharge was small and met permit limits.

INTRODUCTION

The Ecology Surface Water Investigations Section (SWIS) conducted a major water quality assessment project on the Snoqualmie River (Joy, in prep). In support of the assessment, the Ecology Compliance Monitoring Section (CMS) collected discharge data from the four NPDES permitted discharges in the study area. The sources include three continuously discharging municipal wastewater treatment plants: North Bend - NPDES Permit No. WA-002935-1; Snoqualmie - NPDES Permit No. WA-002240-3; and Duvall - NPDES Permit No. WA 002951-3(M); and one intermittent industrial discharge - the Weyerhaeuser (Weyco) Snoqualmie Log Pond - NPDES Permit No. WA-000173-2(I).

The project was conducted during the July-September 1989 low flow period. Four sampling visits were made to each discharger in conjunction with the river assessment sampling. Sampling dates were July 25-26, August 15-16, September 5-6, and September 26-27, 1989. Inspection objectives at the NPDES permitted facilities were:

1. Provide discharge data to support the four river assessment sampling efforts.

2. Do one Class II inspection at each of the municipal dischargers. Class II inspection objectives included:

    a. Assess plant compliance with NPDES permit limits.

    b. Review lab procedures to determine conformance with standard techniques. Samples were split with the permittee to determine the comparability of Ecology laboratory analysis and permittee laboratory analysis.

    c. Characterize toxicity with influent and effluent priority pollutant scans and effluent bioassays.

    d. Characterize sludge with a priority pollutant scan.

Conducting the inspections were Keith Seiders and Marc Heffner of the Ecology CMS. The operators provided assistance at the wastewater treatment plants (STPs); Doug Repp at North Bend, Dean Collins at Snoqualmie, and Dean Castinelli and John Light at Duvall.

PROCEDURES

Class II Inspection Monitoring

One Class II inspection was conducted at each municipal discharger; at the North Bend STP on July 25-26, at the Duvall STP on August 15-16, and at the Snoqualmie STP on September 5-6.

Ecology sampling included grab and composite samples. Ecology Isco priority pollutant composite samplers were set up to collect influent and effluent samples. Approximately 350 mLs of sample were collected every 30 minutes for 24 hours. The compositors were iced to cool samples immediately upon collection. The STP operator collected concurrent influent and effluent composite samples with the plant samplers. Also, Ecology grab composite samples, consisting of three subsamples, were collected for bioassays.

Ecology quality assurance included priority pollutant cleaning the composite samplers prior to the inspection and collection of transfer blanks on site for priority pollutant analysis (Table 1). Replicate samples were also collected during the inspections for analysis by the Ecology laboratory. Replicate samples for most parameters were collected by filling a large container, thoroughly mixing, then pouring subsamples in the field for submission to the laboratory for analysis. Fecal coliform replicates were collected by taking two samples in rapid succession.

All composite samples were split for analysis by the Ecology and STP laboratories. Samples collected, sampling times, and parameters analyzed are summarized in tables included in the results and discussion portion of the report.

Bioassay samples were placed on ice and shipped overnight delivery to ERCE Bioassay Laboratory. Samples for analysis by Ecology were placed on ice and shipped to the Ecology Manchester Laboratory. Analytical methods and laboratories doing the analysis are summarized in Table 2.

Ecology instantaneous flow measurements for comparison with the in-plant flowmeter were made during the inspection and selected other plant visits. Also, sludge depths were measured several times in the clarifiers and chlorine contact basins using a sludge judge core sampler.

Non-Class II Inspection Monitoring

Limited Ecology sampling was conducted during survey weeks at the municipal dischargers not scheduled for a Class II inspection. Effluent grab and composite samples were collected. At each facility an Ecology Isco composite sampler collected approximately 200 mLs of sample every 30 minutes for 24 hours. Prior to sample collection the sampler was cleaned for metals sampling (Table 1). Samples collected, sampling times, and parameters analyzed are summarized in tables included in the results and discussion portion of the report.

Weyco Log Pond grab samples and a grab composite sample were collected during each survey week. The grab composite consisted of three samples of equal volume. Samples collected, sampling times, and parameters analyzed are summarized in a table included in the results and discussion portion of the report.

Samples for analysis by Ecology were placed on ice and shipped to the Ecology Manchester Laboratory. Analytical methods and laboratories doing the analysis are summarized in Table 2.

Table 1. Priority Pollutant Cleaning and Field Transfer Blank Procedures-SRD, 1989

PRIORITY POLLUTANT SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent.
2. Rinse several times with tap water.
3. Rinse with 10% HNO_3 solution.
4. Rinse three (3) times with distilled/deionized water.
5. Rinse with high purity methylene chloride.
6. Rinse with high purity acetone.
7. Allow to dry and seal with aluminum foil.

METALS SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent.
2. Rinse several times with tap water.
3. Rinse with 10% HNO_3 solution.
4. Rinse three (3) times with distilled/deionized water.
5. Allow to dry and seal with aluminum foil.

FIELD TRANSFER BLANK PROCEDURE

1. Pour organic free water directly into appropriate bottles for parameters to be analyzed from grab samples (VOA).

2. Run approximately 1L of organic-free water through a compositor and discard.

3. Run approximately 6L of organic-free water through the same compositor and put the water into appropriate bottles for parameters to be analyzed from composite samples (BNA, Pesticide/PCB, and metals).

Table 2. Ecology Analytical Methods and Test Laboratories - SRD, 1989.

	Method Used for Ecology Analysis (Ecology, 1988&89)	Laboratory Performing Analysis
Laboratory Analyses		
Turbidity	EPA #180.1	Ecology
Conductivity	EPA #120.1	Ecology
Alkalinity	EPA #310.1	Ecology
Hardness	EPA #130.2	Ecology
Chloride	EPA #300.0	Ecology
NH_3-N	EPA #350.1	AR
NO_3+NO_2-N	EPA #353.2	AR
Total-P	EPA #365.1	AR
Ortho-P	EPA #365.1	AR
TS	EPA #160.3	Ecology
TNVS	EPA #160.4	Ecology
TSS	EPA #160.2	Ecology
TNVSS	EPA #160.4	Ecology
COD	EPA #410.1	Ecology
BOD_5	EPA #405.1	AR
Inhib. BOD_5	EPA #405	AR
Fecal Coliform (MF)	APHA, 1985: #909C	Ecology
TOC (sed/sludge)	Tetra Tech, 1986	ARI
% Solids	EPA #160.3	ARI
Cyanide	EPA #335.3	ARI
VOA (water)	EPA #624	PNEL
VOA (sed/sludge)	EPA #8240	PNEL
BNA (water)	EPA #625	PNEL
BNA (sed/sludge)	EPA #8270	PNEL
Pest/PCB (water)	EPA #608	PNEL
Pest/PCB (sed/sludge)	EPA #8080	PNEL
pp metals	EPA #200	Ecology
Trout	EPA, 1985a	ERCE
Fathead Minnow	EPA, 1985a	ERCE
Ceriodaphnia	EPA, 1985b	ERCE
Field Analyses		
pH	APHA, 1985: #423	Ecology
Conductivity	APHA, 1985: #205	Ecology
Temperature	APHA, 1985: #212	Ecology
Chlorine Residual	APHA, 1985: #408E	Ecology

AR - Aquatic Research
ARI - Analytical Resources Inc.
ERCE - ERCE Bioassay Laboratory
PNEL - Pacific Northwest Environmental Laboratory

NORTH BEND

SETTING

The North Bend STP is an oxidation ditch type secondary system with a design monthly average flow of 0.4 MGD (Figure 1). The oxidation ditch and both secondary clarifiers were operating during all visits. The chlorine contact chambers were operated on an alternating basis; one in service and one being cleaned. Flow measurement at the plant included an in-line influent flowmeter and an effluent Parshall flume. The effluent meter flow totalizer was not functioning during the inspections.

Waste activated sludge is sent to an aerobic digester and then to drying beds. During the inspection period, the aerobic digester was off line for modification to allow variable level supernatant draw-off and sludge was not wasted. Historically final sludge disposal had been at the city dump, but since the dump was closed approximately one year before the inspection, there had been no final disposal. Dried sludge, ready for disposal, had been piled in the drying bed pending a decision on final disposal.

Samples collected, sampling times, and parameters analyzed are summarized in Table 3. Sample locations are illustrated in Figure 1.

RESULTS AND DISCUSSION

Flow Measurement

The influent in-line flowmeter was used for flow measurement during the inspections (Table 4). Ecology instantaneous measurements at the effluent six-inch Parshall flume corresponded poorly with the influent plant meter instantaneous flow measurements. The plant operator did further comparisons between the influent and effluent measurements and found the influent meter measurements were routinely low. The influent flow measurements were estimated to be approximately 60 percent of the actual flow; thus, inspection influent flow measurements were appropriately adjusted for use in this report. The operator began consistently using the effluent meter for NPDES permit reporting in approximately June 1990. Flows reported prior to June 1990 should be inspected carefully to ascertain the measurement point and to adjust the flow as necessary.

Conventional Parameters/NPDES Permit Compliance

Plant performance during the first two visits was excellent, but declined during the last two visits (Table 5). Effluent NH_3-N concentrations were less than 1 mg/L during all the visits suggesting biological treatment was good throughout the study period. During the last two inspections, solids carryover in the secondary clarifiers was observed. Effluent TSS concentrations were 60 mg/L on September 5-6 and 160 mg/L on September 26-27. Sludge depth measurements made using a sludge judge found some clearwater in the secondary clarifiers during the September 26 - 0830 measurement (four - five feet) but no clearwater in the September 26 - 1330 measurement (Table 6). The operator had previously observed rising sludge blankets in the afternoon. Lack of sludge wasting likely contributed to the problem.

Results comparison with NPDES permit effluent limits showed compliance during the July 24-25 and August 15-16 visits (Table 7). The September 5-6 visit found BOD_5 exceeding the monthly average concentration limit and TSS exceeding the weekly and monthly average concentration and monthly average loading limits. The September 26-27 visit found BOD_5 and TSS exceeding monthly and weekly average limits with the exception of the BOD_5 monthly average loading limit. Also, one of the fecal coliform samples collected on September 26 greatly exceeded the permit limits; sample concentration - 120000/100mL, weekly average limit - 400/100mL.

Priority Pollutants - Water Samples

Organics concentrations in the effluent sample were low (Table 8). Dibromochloromethane was the organic found in the highest concentration (6 μg/L). Alpha-Chlordane (estimated concentration 0.092 μg/L), which exceeded the chronic freshwater toxicity criteria, was the only organic found in the effluent in excess of freshwater toxicity criteria (EPA, 1986b). Several organics were found in the influent sample. Acetone (100-200 μg/L), 4-Methylphenol (44 μg/L), and total phthalate esters (38 μg/L-estimated) were found in the highest concentrations. Most compounds found in the influent were removed from the liquid stream during the treatment process. A complete list of priority pollutant scan target compounds and detection limits is included in Appendix A.

Compounds tentatively identified in the scan are noted in Appendix B. More compounds and higher concentrations were noted in the influent than in the effluent.

Several metals were detected (Table 8). Metals exceeding chronic toxicity criteria in one or more effluent sample include lead and mercury. Metals exceeding chronic and acute toxicity criteria in one or more effluent sample include copper, silver, and zinc.

Bioassays - Water

Effluent toxicity was minimal in the bioassays. All LC_{50}s, NOECs, and LOECs calculated were greater than 100 percent effluent (Table 9).

Sludge

Approximately twenty organic priority pollutants were detected in the sludge sample (Table 8). Most of the compounds detected were polynuclear aromatic hydrocarbons (PAHs). Concentrations of most of these compounds were estimated below the reliable quantification limit. The PAH compounds were not detected in the water samples. A complete list of priority pollutant scan target compounds and detection limits is included in Appendix C. Compounds tentatively identified in the scan are noted in Appendix D.

North Bend sludge metals concentrations fell below the geometric mean of samples collected during previous Class II Inspections at activated sludge plants in Washington (Table 8; Hallinan, 1988).

Laboratory Procedure Review/Sample Splits

Laboratory and sampling procedures at the plant were generally acceptable. Minor recommendations are included in the "Laboratory Procedure Review Sheet" included in Appendix E.

The split samples results comparison was acceptable (Table 10). The STP and Ecology laboratory results for the Ecology influent sample do not compare as closely as desired, but the other comparisons all suggest a good correlation between the two laboratories.

RECOMMENDATIONS AND CONCLUSIONS

Flow Measurement

The influent flowmeter was inaccurate; registering flow at approximately 60 percent of the actual rate. The effluent flowmeter was repaired after the inspections and should be maintained and used.

Conventional Parameters/NPDES Permit Compliance

The plant was operating well during the first two visits, but performance then deteriorated. Effluent BOD_5 and TSS were not within all limits during the second two visits. Also, one sample with a high fecal coliform count was collected on September 25.

Priority Pollutants - Water Samples

Effluent organic concentrations were low. Effluent concentrations of alpha-Chlordane and several metals exceeded freshwater toxicity criteria.

Bioassays - Water

Effluent toxicity was minimal.

Sludge

Approximately twenty organics were detected; most below reliable quantification limits. Many of the organics were PAHs. Metals concentrations fell below statewide historical averages.

Laboratory Procedure Review/Sample Splits

Analytical and sampling procedures were acceptable. Recommendations for minor changes are included in Appendix E.

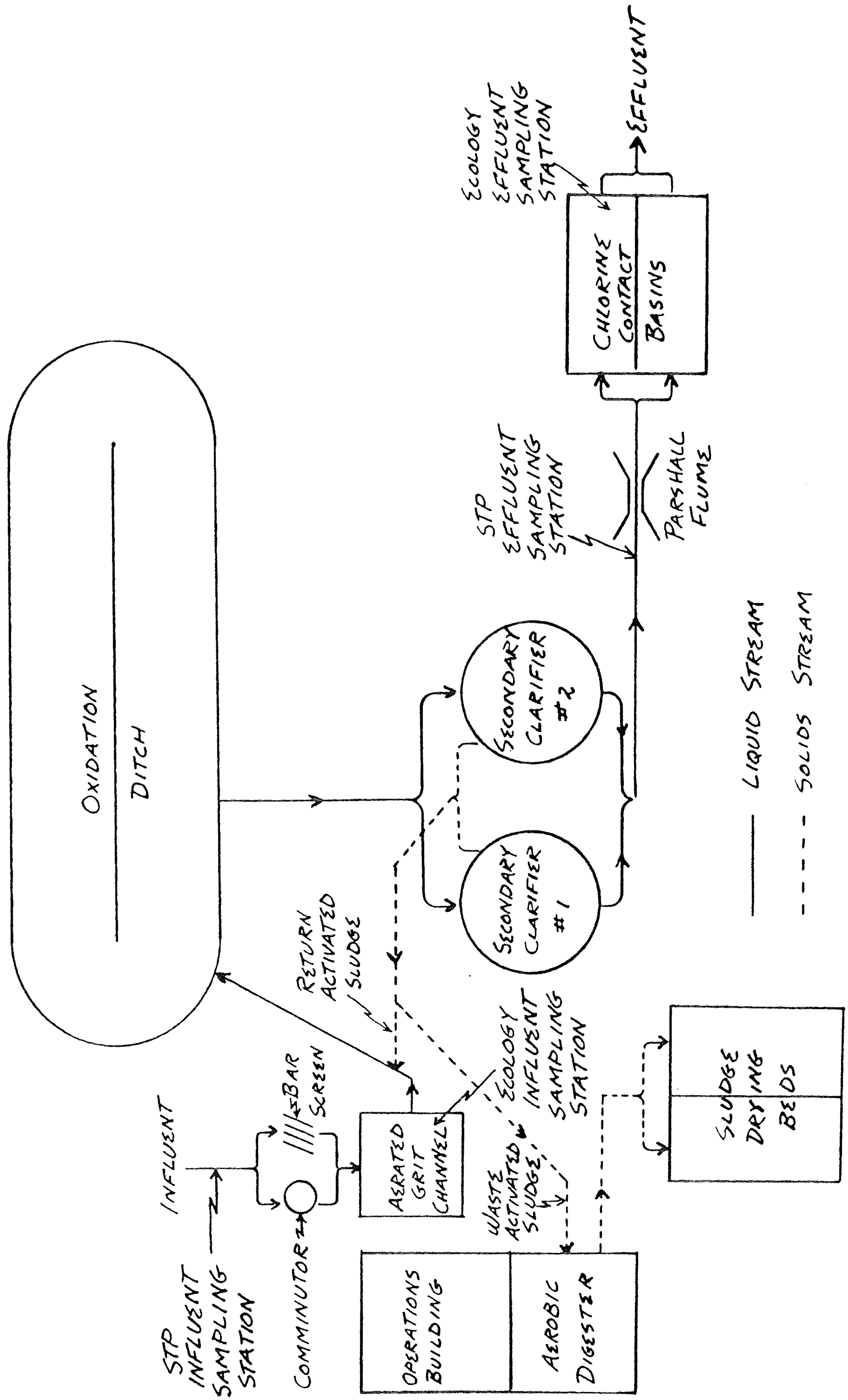

Figure 1. North Bend STP Flow Scheme - SRD, 1989.

Table 3. North Bend STP Sample Collection - SRD, 1989.

7/25-26

Lab Log-Numbers:	308080	308085	308086		308081	308082	308087	308088	308089		308083	308084
Sample:	Blank	Influent	Influent	Influent	ECO-Inf	STP-Inf	Effluent	Effluent	Ef- Dup	Effluent	ECO- Ef	STP-Ef
Date:	7/25	7/25	7/25	7/26	7/25-26	7/25-26	7/25	7/25	7/25	7/26	7/25-26	7/25-26
Time:	0835	0945	1420	0910	0915-0915	0915-0915	0930	1430	1430	0850	0915-0915	0915-0915
Type:		Grab	Grab	Grab	Composite	Composite	Grab	Grab	Grab	Grab	Composite	Composite
Field Analyses												
pH		E	E	E	E	E	E	E		E	E	E
Temperature		E	E	E	E	E	E	E		E	E	E
Conductivity		E	E	E	E	E	E	E		E	E	E
Chlorine Residual												
Total							E	E		E		
Free							E	E		E		
Laboratory Analyses												
Turbidity					E	E	E	E	E		E	E
Conductivity					E	E	E	E	E		E	E
Alkalinity					E	E	E	E	E		E	E
Hardness					E	E	E	E	E		E	E
Chloride					E	E	E	E	E		E	E
Cyanide					E						E	
TS					E	E					E	E
TNVS					E	E					E	E
TSS					E S	E S	E	E	E		E S	E S
TNVSS					E	E					E	E
BOD_5					E S	E S					E S	E S
Inhib. BOD_5					E						E	
COD					E	E	E	E	E		E	E
TOC												
NH_3-N					E	E	E	E	E		E	E
NO_3+NO_2-N					E	E	E	E	E		E	E
Total-P					E	E	E	E	E		E	E
Ortho-P					E	E	E	E	E		E	E
% Solids												
Fecal Coliform							E	E	E			
pp metals	E				E						E	
BNA	E				E						E	
VOA	E	E	E				E	E				
Pest/PCB	E				E						E	
Trout											E*	
Fathead Minnow											E*	
Ceriodaphnia dubia											E*	

E - Ecology Laboratory Analysis
S - Sewage Treatment Plant Laboratory Analysis
* - Bioassay samples were hand composites made by mixing equal volumes of the three 7/25-26 effluent grab samples.

Table 3. (Continued) - SRD, 1989.

	8/15-16					9/5-6				9/26-27				
Lab Log-: Numbers:	338419	338420		338416	338426 338427	368250	368251		368247	398186	398187	398189		398193
Sample:	Effluent	Effluent	Effluent	Effluent	Sludge	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	Ef-Dup	Effluent	Effluent
Date:	8/15	8/15	8/16	8/15-16	8/16	9/5	9/5	9/6	9/5-6	9/26	9/26	9/26	9/27	9/26-27
Time:	0815	1350	0830	0830-0830	0845	0815	1315	0810	0830-0830	0830	1320	1320	0810	0830-0830
Type:	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Grab	Composite
Field Analyses														
pH	E	E	E	E		E	E	E	E	E	E		E	E
Temperature	E	E	E	E		E	E	E	E	E	E		E	E
Conductivity	E	E	E	E		E	E	E	E	E	E		E	E
Chlorine Residual														
Total	E	E	E			E	E	E		E	E		E	
Free	E	E	E			E	E	E		E	E		E	
Laboratory Analyses														
Turbidity				E					E					E
Conductivity				E					E					E
Alkalinity				E					E					E
Hardness				E					E					E
Chloride				E					E					E
Cyanide														
TS				E					E					E
TNVS				E					E					E
TSS				E					E					E
TNVSS				E					E					E
BOD_5				E					E					E
Inhib. BOD_5														
COD				E					E					E
TOC					E									
NH_3-N				E					E					E
NO_3+NO_2-N				E					E					E
Total-P				E					E					E
Ortho-P				E					E					E
% Solids					E									
Fecal Coliform	E	E S				E	E			E	E	E		
pp metals				E	E				E					E
BNA					E									
VOA					E									
Pest/PCB					E									
Trout														
Fathead Minnow														
Ceriodaphnia dubia														

E - Ecology Laboratory Analysis
S - Sewage Treatment Plant Laboratory Analysis
* - Bioassay samples were hand composites made by mixing equal volumes of the three 7/25-26 effluent grab samples.

Table 4. North Bend STP Flow Measurements - SRD, 1989.

Influent Flowmeter Measurements

Date Month	Day	Time	Totalizer reading	Flow for time increment (MGD)
7/25-26				
7	25	845	546755	
				0.192
7	25	1430	546801	
				0.116
7	26	815	546887	

Average flowmeter flow = 0.135
Adjusted average flow = 0.23 MGD +

Date Month	Day	Time	Totalizer reading	Flow for time increment (MGD)
8-15/16				
8	15	810	549816	
				0.195
8	15	1350	549862	
				0.127
8	16	855	549963	

Average flowmeter flow = 0.143
Adjusted average flow = 0.24 MGD +

Influent Flowmeter Measurements

Date Month	Day	Time	Totalizer reading	Flow for time increment (MGD)
9/5-6				
9	5	830	552867	
				0.197
9	5	1315	552906	
				0.130
9	6	830	553010	

Average flowmeter flow = 0.143
Adjusted average flow = 0.24 MGD +

Date Month	Day	Time	Totalizer reading	Flow for time increment (MGD)
9/26-27				
9	26	820	555666	
				0.139
9	27	925	555811	

Average flowmeter flow = 0.139
Adjusted average flow = 0.23 MGD +

\+ based on Ecology instantaneous flow measurements and further checks by the operator, the influent flowmeter measurements were estimated to be approximately 60 percent of the actual flow.

Table 4. (Continued) - SRD, 1989.

Instantaneous Flow Measurements (MGD)

Month	Day	Time	Ecology *	Plant Meter *	Plant Meter **
7	26	1045	0.28	0.25	0.14
9	26	1345	0.29		
9	27	925	0.25		0.15

* at effluent 6 inch Parshall flume
** influent flowmeter

Table 5. North Bend STP-Ecology Laboratory Results-SRD, 1989.

7/25 - 26

Lab Log Numbers:	308080	308085	308086		308081	308082	308087	308088	308089		308083	308084
Sample:	Blank	Influent	Influent	Influent	ECO-Inf	STP-Inf	Effluent	Effluent	Ef- Dup	Effluent	ECO- Ef	STP-Ef
Date:	7/25	7/25	7/25	7/26	7/25-26	7/25-26	7/25	7/25	7/25	7/26	7/25-26	7/25-26
Time:	0835	0945	1420	0910	0915-0915	0915-0915	0930	1430	1430	0850	0915-0915	0915-0915
Type:		Grab	Grab	Grab	Composite	Composite	Grab	Grab	Grab	Grab	Composite	Composite
Field Analyses												
pH (S.U.)		7.5	7.7	7.3	7.5	7.0	7.3	7.2		7.1	7.3	7.4
Temperature (°C)		17.7	17.9	17.9	5.7	13.7	18.1	19.3		18.7	6.7	13.1
Conductivity (umhos/cm)		430	471	395	390	370	280	275		275	300	275
Chlorine Residual (mg/L)												
Total							0.2	0.6		0.6		
Free							0.2	0.2		<0.1		
Laboratory Analyses												
Turbidity (NTU)					62	52	2.0	1.9	2.0		1.7	1.8
Conductivity (umhos/cm)					375	310	265	263	265		270	269
Alkalinity (mg/L $CaCO_3$)					130	128	74	72	72		73	77
Hardness (mg/L $CaCO_3$)					55	44	49	50	49		50	54
Chloride (mg/L)					21.2	21.5	22.2	23.8	23.1		23.2	21.4
Cyanide (μg/L)					5 U						5 U	
TS (mg/L)					440	500					160	170
TNVS (mg/L)					140	160					130	140
TSS (mg/L)					150	170	9	6	3		6	6
TNVSS (mg/L)					16	24					4	6
BOD_5 (mg/L)					190 J	140 J					5 J	5 J
Inhib. BOD_5 (mg/L)					160 J						4 UJ	
COD (mg/L)					414	509	21	18	19		18	16
TOC (mg/gm dry-wt)												
NH_3-N (mg/L)					15.8	13.2	0.52	0.17	0.24		0.69	0.19
NO_3+NO_2-N (mg/L)					0.17	0.02 U	0.46	0.38	0.47		0.22	0.21
Total-P (mg/L)					2.4	3.7	0.78	1.8	1.6		1.6	1.7
Ortho-P (mg/L)					2.9 J	2.2 J	0.45 J	0.96 J	0.78 J		0.97 J	0.97 J
% Solids												
Fecal Coliform (#/100mL)							220	3	3 U			
Antimony (μg/L)	2.0 U				2.0 U						2.0 U	
Arsenic (μg/L)	1.0 U				3.8						4.2	
Beryllium (μg/L)	2.0 U				2.0 U						2.0 U	
Cadmium (μg/L)	5.0 U				5.0 U						5.0 U	
Chromium (μg/L)	5.0 U				5.0 U						5.0 U	
Copper (μg/L)	4.0 U				40.2						4.0 U	
Lead (μg/L)	1.0 U				5.4 B						5.7 B	
Mercury (μg/L)	0.06 U				0.17						0.06 U	
Nickel (μg/L)	20 U				20 U						20 U	
Selenium (μg/L)	2.0 U				2.0 U						2.0 U	
Silver (μg/L)	0.50 U				1.0						0.50 U	
Thallium (μg/L)	1.0 U				1.0 U						1.0 U	
Zinc (μg/L)	40.6 B				120 B						95.1 B	

Table 5. (Continued) - SRD, 1989.

	8/15-16					9/5-6				9/26-27				
Lab Log-: Numbers:	338419	338420		338416	338426 338427	368250	368251		368247	398186	398187	398189		398193
Sample:	Effluent	Effluent	Effluent	Effluent	RAS	Effluent	Effluent	Effluent	Effluent	Effluent	Effluent	EF-Dup	Effluent	Effluent
Date:	8/15	8/15	8/16	8/15-16	8/16	9/5	9/5	9/6	9/5-6	9/26	9/26	9/26	9/27	9/26-27
Time:	0815	1350	0830	0830-0830	0845	0815	1315	0810	0830-0830	0830	1320	1320	0915	0830-0830
Type:	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Grab	Composite
Field Analyses														
pH (S.U.)	6.8	6.7	7.0	7.3		7.1	7.0	7.3	7.3	7.4	6.8		7.4	7.7
Temperature (°C)	17.5	17.8	17.2	5.0		16.9	17.9	16.5	3.9	16.0	16.7		15.8	4.0
Conductivity (umhos/cm)	301	315	318	309		301	289	286	277	260	270		260	269
Chlorine Residual (mg/L)														
Total	0.6	0.5	0.5			0.3	0.3	0.5		0.5	0.3		0.5	
Free	<0.1	<0.1	<0.1			<0.1	0.1	<0.1		<0.1	<0.1		<0.1	
Laboratory Analyses														
Turbidity (NTU)				1.4					16					38
Conductivity (umhos/cm)				317					308					281
Alkalinity (mg/L $CaCO_3$)				39					72					68
Hardness (mg/L $CaCO_3$)				57					57					58
Chloride (mg/L)				25.4					25.8					23.9
Cyanide (µg/L)														
TS (mg/L)				240					100					400
TNVS (mg/L)				160					90					180
TSS (mg/L)				3					60					160
TNVSS (mg/L)				1 U					10					4
BOD_5 (mg/L)				4 J					35 J*					64
Inhib. BOD_5 (mg/L)														
COD (mg/L)				24					81					249
TOC (mg/gm dry-wt)					320**									
NH_3-N (mg/L)				0.92 J					0.21					0.66
NO_3+NO_2-N (mg/L)				8.5 J					1.2					0.29
Total-P (mg/L)				5.4 J					5.9					6.0
Ortho-P (mg/L)				4.2 J					5.0					2.5
% Solids					0.34									
Fecal Coliform (#/100mL)	8	3				23	26			14	12000	15000		
Antimony (µg/L)				3.0 U	6.0 U				3.0 U					3.0 U
Arsenic (µg/L)				5.7 R	24.8				3.2 R					1.0 UR
Beryllium (µg/L)				2.0 U	0.50 U				2.0 U					2.0 U
Cadmium (µg/L)				5.0 U	16				5.0 U					5.0 U
Chromium (µg/L)				5.0 U	34				5.0 U					5.0 U
Copper (µg/L)				14	1270				33					79.3
Lead (µg/L)				1.0 U	150				3.3 B					9.2 B
Mercury (µg/L)				0.06 U	8.7				0.13					0.38
Nickel (µg/L)				20 U	62				20 U					20 U
Selenium (µg/L)				2.0 U	6.0 J				2.0 U					2.0 U
Silver (µg/L)				0.50 U	21.3				0.50 U					6.7
Thallium (µg/L)				2.0 U	2.0 U				1.0 U					1.0 U
Zinc (µg/L)				69.8 B	1900				94.7					196

Table 5. (Continued) - SRD, 1989.

*	possible toxic effect - BOD_5 = 13J mg/L at dilution factor of 2.0: BOD_5 = 35J mg/L at dilution factor 10.0
**	average of sample result (400 mg/gm dry wt) and duplicate analysis (240 mg/gm dry wt).
U	indicates compound was analyzed for but not detected at the given detection limit.
J	indicates an estimated value.
B	This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.
UJ	indicates compound was analyzed for but not detected at the given detection limit, and the internal standard on which detection limit quantification was based was outside acceptance limits.
R	low spike recovery - result may be biased low.
UR	indicates compound was analyzed for but not detected at the given detection limit, and the spike recovery was low so the actual detection limit may be higher.

Table 6. North Bend STP Sludge Depth Measurements - SRD, 1989.

Date	Time	Unit **	Tank Depth (ft)	Sludge Blanket Thickness (ft)	Poorly Settled Sludge Layer (ft)	Clear-water Depth (ft)
7/25	1420	Clarifier #1	10.0	1.0	6.0	3.0
		Clarifier #2	10.0	1.0	6.0	3.0
		Cl_2 Contact Basin *	9.5	0.5		9.0
7/26	1030	Clarifier #1	10.0	2.0		8.0
		Clarifier #2	10.0	8.0		2.0
		Cl_2 Contact Basin *	9.5	1.0		8.5
8/16	0855	Cl_2 Contact Basin *				+
9/5	0815	Cl_2 Contact Basin *				+
9/5	1320	Clarifier #1	10.0	1.5	8.5	
		Clarifier #2	10.0	1.5	7.0	1.5
		Cl_2 Contact Basin *	9.5	5.0		4.5 +
9/6	0830	Clarifier #1	10.0		5.0	5.0
		Clarifier #2	10.0		6.0	4.0
9/26	1330	Clarifier #1	10.0		10.0 ++	
		Clarifier #2	10.0		10.0 ++	
		Cl_2 Contact Basin *	9.5		9.5	

* Cl_2 contact basin samples collected near outlet unless otherwise specified.

** see Figure 1 for numbering system.

\+ a layer of floating sludge was trapped behind the floating solids retention bar on the surface of the contact chamber. The maximum depth of floating solids observed was 3-4 inches on 9/5 at 1320.

++ overflow weirs were partially plugged

Table 7. North Bend STP-Comparison of Inspection Results with NPDES Permit Limits-SRD, 1989.

Parameter *	NPDES Permit Limits Monthly Average	Weekly Average	7/25-26 Ecology Samples	7/25-26 STP Samples	8/15-16 Ecology Samples	9/5-6 Ecology Samples	9/26-27 Ecology Samples
BOD_5							
(mg/L)	30	45	5 J	5 J	4 J	35 J	64
(lbs/D)	100	150	10	10	8	70	123
(% removal)	85		97	96			
TSS							
(mg/L)	30	45	6	6	3	60	160
(lbs/D)	100	150	12	12	6	120	307
(% removal)	85		96	96			
Fecal coliform (#/100 mL)	200	400	220 3 U+ 3 +		8 3	23 26	14 12000+ 15000+
pH (S.U.)	shall not be outside the range 6.0 - 9.0		7.3,7.2, 7.1		6.8,6.7, 7.0	7.1,7.0, 7.3	7.4,6.8, 7.4
Flow (MGD)			0.23	0.23	0.24	0.24	0.23

* Ecology analytical results - composite samples for BOD_5 and TSS grab samples for pH and fecal coliforms.

\+ duplicate analysis.

J estimated.

U less than.

Table 8. North Bend STP Priority Pollutants Detected and Toxicity Criteria Comparison - SRD, 1989.

	Transfer Blank	North Bend Influent		North Bend Sludge				
Lab Log #:	308080	308085	308086	338427				
Type:		Grab	Grab	Grab				
Date:	7/25	7/25	7/25	8/16				
Time:	0835	0945	1420	0845				
% Solids				**				
TOC (% dry wt basis)				32				
VOA Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/Kg dry wt)			
Acetone	-	100	200	-	-			
Chloroform	-	2 J	2 J	-	-			
Bromodichloromethane	-	-	-	-	-			
Dibromochloromethane	-	-	-	-	-			
Bromoform	-	-	-	-	-			
Tetrachloroethene	-	5	7	-	-			
Toluene	-	2 J	2 J	-	-			
Lab Log #:	308080	308081		338427				
Type:		ECO-Comp		Grab				
Date:	7/25	7/25-26		8/16				
BNA Compounds	(µg/L)	(µg/L)		(µg/L)	(µg/Kg dry wt)			
Phenol	-	6 J		3 J	660 J			
1,4-Dichlorobenzene	-	2 J		-	-			
Benzyl Alcohol	-	9 J		-	-			
4-Methylphenol	-	44		-	-			
Benzoic Acid	-	15 J		-	-			
Dibenzofuran	-	-		2 J	390 J			
N-Nitrosodiphenylamine	-	-		96	25000			
Pentachlorophenol	-	-		3 J	880J			
Phthalate Esters								
Diethyl Phthalate	-	6 J		-	-			
Di-n-Butyl Phthalate	-	2 J		83 B	21000 B			
Butylbenxylphthalate	-	4 J		2 J	580J			
Bis(2-Ethylhexyl)phthalate	-	25		91	23000			
Di-n-Octyl Phthalate	-	1 J		-	-			
LPAH ++								
Acenaphthene	-	-		11	2900			
Fluorene	-	-		5 J	1200 J			
Phenanthrene	-	-		10	2600			
Anthracene	-	-		4 J	910 J			
HPAH +++								
Fluoranthene	-	-		10	2400			
Pyrene	-	-		11	2800			
Benzo(a)Anthracene	-	-		3 J	890 J			
Chrysene	-	-		4 J	1000 J			
Benzo(b)Fluoranthene	-	-		2 J	640 J			
Benzo(k)Fluoranthene	-	-		2 J	500 J			
Benzo(a)Pyrene	-	-		2 J	510 J			
Pest/PCB Compounds								
gamma-BHC (Lindane)	-	0.01 J		1.4 D	360 D			
alpha-Chlordane	-	-		-	-			
Lab Log #:	308080	308081		338426		Statewide Class II Sludge Data ***		
Type:		ECO-Comp		Grab				
Date:	7/25	7/25-26		8/16		Geometric Mean	Range	# Sampled
Metals	(µg/L)	(µg/L)		(µg/L)	(mg/Kg dry wt)	(mg/Kg dry wt)		
Arsenic	-	3.8		24.8	7.3			
Cadmium	-	-		16	4.7	7.6	<0.1-25	34
Chromium	-	-		34	10	62	15-300	34
Copper	-	40.2		1270	374	400	75-1700	34
Lead	-	5.4 B		150	44	210	34-600	34
Mercury	-	0.17		8.7	2.6			
Nickel	-	-		62	18	26	<0.1-62	29
Selenium	-	-		6.0 J	1.8 J			
Silver	-	1.0		21.3	6.3			
Zinc	40.6 B	120 B		1900	559	1200	165-3370	33

Table 8. (Continued) - SRD, 1989.

North Bent Effluent

Sample:			Freshwater Toxicity Criteria (EPA, 1986b)	
Lab Log #:	*308087*	*308088*		
Type:	Grab	Grab		
Date:	7/25	7/25		
Time:	0930	1430	Acute	Chronic
% Solids				
TOC (% dry wt basis)				
VOA Compounds	(μg/L)	(μg/L)	(μg/L)	(μg/L)
Acetone	-	-		
Chloroform	-	2 J	28900*	1240*
Bromodichloromethane	1 J	5		
Dibromochloromethane	-	6		
Bromoform	-	2 J		
Tetrachloroethene	-	-		
Toluene	2 J	-	17500*	

		Freshwater Toxicity Criteria (EPA, 1986b)	
Lab Log #:	308083		
Type:	ECO-Comp		
Date:	7/25-26	Acute	Chronic
BNA Compounds	(μg/L)	(μg/L)	(μg/L)
Phenol	-		
1,4-Dichlorobenzene	-		
Benzyl Alcohol	-		
4-Methylphenol	-		
Benzoic Acid	-		
Dibenzofuran	-		
N-Nitrosodiphenylamine	-		
Pentachlorophenol	-		
Phthalate Esters			
Diethyl Phthalate	-		
Di-n-Butyl Phthalate	-		
Butylbenxylphthalate	-		
Bis(2-Ethylhexyl)phthalate	-		
Di-n-Octyl Phthalate	-		
LPAH ++			
Acenaphthene	-		
Fluorene	-		
Phenanthrene	-		
Anthracene	-		
HPAH +++			
Fluoranthene	-		
Pyrene	-		
Benzo(a)Anthracene	-		
Chrysene	-		
Benzo(b)Fluoranthene	-		
Benzo(k)Fluoranthene	-		
Benzo(a)Pyrene	-		
Pest/PCB Compounds			
gamma-BHC (Lindane)	0.27	100*	
alpha-Chlordane	0.092 J	2.4	0.0043

					Freshwater Toxicity Criteria (EPA, 1986b)	
Lab Log #:	308083	338416	368247	398193		
Type:	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp		
Date:	7/25-26	8/15-16	9/5-6	9/26-27	Acute	Chronic
Metals	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)
Arsenic	4.2	5.7 R	3.2 R	-	850(360)*+	48(190)*+
Cadmium	-	-	-	-		
Chromium	-	-	-	-		
Copper	-	14	33	79.3	10+	7+
Lead	5.7 B	-	3.3 B	9.2 B	37+	1.5+
Mercury	-	-	0.13	0.38	2.4	0.012
Nickel	-	-	-	-		
Selenium	-	-	-	-		
Silver	-	-	-	6.7	1.4+	0.12
Zinc	95.1 B	69.8 B	94.7	196	69+	63+

Table 8. (Continued) - SRD, 1989.

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* insufficient data to develop criteria - Lowest Observed Effect Level (LOEL) presented.

** 0.39% solids were found in the organics sample - used for dry weight calculations of organics. 0.34% solids were found in the TOC sample - used for dry weight calculations of metals.

*** summary of data collected during previous Class II Inspections statewide at activated sludge plants (Hallinan, 1988).

\+ calculation based on hardness (54 mg/L).

*+ Pent(Tri) - Pent is LOEL.

++ LPAH - low molecular weight polynuclear aromatic hydrocarbons.

+++ HPAH - high molecular weight polynuclear aromatic hydrocarbons.

J indicates an estimated value when result is less than specified detection limit.

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.

R low spike recovery - result may be biased low.

D value from analysis of a diluted sample.

Table 9. North Bend STP Effluent Bioassay Results - SRD, 1989.

Rainbow Trout (*Oncorhynchus mykiss*) - 96 hour survival test

Sample	# Tested	# Survived	Percent Mortality	Percent Survival
Control	20	20	0	100
6.25 % Effluent	20	20	0	100
12.5 % Effluent	20	20	0	100
25.0 % Effluent	20	19	5	95
50.0 % Effluent	20	20	0	100
100 % Effluent	20	20	0	100

96 hr LC_{50} > 100% effluent

Ceriodaphnia dubia - 48 hour survival and 7 day reproduction test

		after 48 hours			after 7 days			
Sample	# Tested	# Survived	Percent Mortality	Percent Survival	# Survived	Percent Mortality	Percent Survival	Mean # Young per Original Female
Control	10	10	0	100	10	0	100	24.7
6.25 % Effluent	10	10	0	100	10	0	100	27.9
12.5 % Effluent	10	10	0	100	10	0	100	27.9
25.0 % Effluent	10	10	0	100	10	0	100	24.9
50.0 % Effluent	10	10	0	100	10	0	100	30.3
100 % Effluent	10	10	0	100	10	0	100	29.2

48 hr LC_{50} > 100% effluent

NOEC > 100% effluent
LOEC N/A

Table 9. (Continued) - SRD, 1989.

Fathead Minnow (*Pimephales promelas*) - 96 hour survival and 7 day growth test

Sample	# Tested	after 96 hours # Survived	after 96 hours Percent Mortality	after 96 hours Percent Survival	after 7 days # Survived	after 7 days Percent Mortality	after 7 days Percent Survival	after 7 days Mean Weight per Fish (mg)
Control	30	30	0	100	30	0	100	0.43
6.25 % Effluent	30	30	0	100	29	3	97	0.30
12.5 % Effluent	30	29	3	97	29	3	97	0.38
25.0 % Effluent	30	30	0	100	29	3	97	0.45
50.0 % Effluent	30	30	0	100	29	3	97	0.54
100 % Effluent	30	29	3	97	29	3	97	0.57

96 hr LC_{50} > 100% effluent

NOEC > 100% effluent
LOEC N/A

NOEC - no observable effects concentration
LOEC - lowest observable effect concentration
LC_{50} - lethal concentration for 50% of the organisms
EC_{50} - effects concentration for 50% of the organisms

Table 10. North Bend STP - Split Sample Results Comparison - SRD, 1989.

Parameter	Laboratory	Lab Log- : Numbers :	308081	308082	308083	308084	338420
		Sample:	ECO-Inf	STP-Inf	ECO- Ef	STP-Ef	Effluent
		Date:	7/25-26	7/25-26	7/25-26	7/25-26	8/15
		Time:	0915-0915	0915-0915	0915-0915	0915-0915	1350
		Type:	Composite	Composite	Composite	Composite	Grab
TSS (mg/L)	Ecology		150	170	6	6	
	North Bend		238	198	5	4	
BOD_5 (mg/L)	Ecology		190 J	140 J	5 J	5 J	
	North Bend		140	136	1	1	
Fecal Coliform (#/100mL)	Ecology						3
	North Bend						*

J estimated value
* operator was unsure which was the split sample.
From his records:
8/14 - 6/100 mL
8/16 - 5/100 mL

SNOQUALMIE

SETTING

The Snoqualmie STP is an aerated lagoon type secondary facility (Figure 2). Treatment units include two aerated lagoon cells and chlorination facilities. Chlorine contact time is provided in the underground line between the chlorination building and the effluent weir.

Influent to the plant comes from three sources: the Town of Snoqualmie; the Snoqualmie Falls Resort area; and domestic waste from Weyco. The Snoqualmie and Weyco force mains empty into a small surge basin and join the Snoqualmie Falls flow just upstream of the influent flowmeter.

Samples collected, sampling times, and parameters analyzed are summarized in Table 11. Sample locations are illustrated in Figure 2.

RESULTS AND DISCUSSION

Flow Measurement

Influent and effluent flows were measured by Snoqualmie. The influent flow was measured at a 3-inch Parshall flume and the effluent flow was measured at a 9-inch rectangular weir (Table 12). Both meters were calibrated on September 5, 1989; midway through the studies. The effluent flowmeter appeared accurate during the three visits it was functioning: Ecology's instantaneous flow measurements agreed closely with effluent meter instantaneous flow measurements. Plant influent and effluent measurements were not in agreement. The influent meter appeared to be measuring accurately, but just before the September 26-27 sampling, the operator discovered and removed a large grease chunk obstructing flow near the Parshall flume. During the September 26-27 visit the influent and effluent flow measurements were nearly equal.

Conventional Parameters/NPDES Permit Compliance

Plant performance during the survey period was fairly consistent (Table 13). Effluent total inorganic nitrogen (TIN = NH_3-N + NO_2+NO_3-N) concentrations were less than 4 mg/L, with NH_3-N concentrations less than 1 mg/L except in the July 25-26 sample (1.9 mg/L). The Ecology September 5-6 influent sample TIN concentration was 16 mg/L. Effluent total-P concentrations ranged from 5-7 mg/L compared to the influent sample concentration of 8 mg/L, suggesting minimal reduction in the plant.

Dissolved oxygen (D.O.) concentrations were measured in the lagoons at the sludge sampling stations between 1545 and 1700 on September 6 (Figure 2). The lagoon temperature was 18°C and, as expected given the sunny day, the D.O. concentrations were quite high. Surface concentrations were 18 mg/L or higher, and two feet depth concentrations were 9.5 to 12 mg/L. The water depth in the lagoons was between 3.5 and 4.0 feet.

Influent pH caused some concern (Table 13). Two of the influent grab samples collected during the September 5-6 sampling had high pHs (9.7 and 11.3). The occurrences appeared to be sporadic as rechecks within 10 minutes were lower (7.9 and 8.8). Several attempts to associate the high pH with one of the three influent sources were unsuccessful. An effort to isolate the source of the high influent pHs is suggested.

Plant compliance with the pH and fecal coliform NPDES permit limits was good while compliance with BOD_5 and TSS limits appeared marginal (Table 14). BOD_5 in the Ecology July 24-25 effluent sample (42 mg/L-estimated) exceeded the monthly concentration limit, and the Ecology BOD_5 analytical result of the September 5-6 STP sample (56 mg/L) exceeded the monthly concentration limit and monthly and weekly loading limits. The STP sample result should be considered carefully because Ecology TSS analysis of the STP sample (150 mg/L) found almost twice the TSS concentration as was found in the corresponding Ecology sample (80 mg/L). TSS concentrations in the Ecology samples collected during the first three visits were slightly greater than the monthly limits, but well below the weekly limits. Operational or physical changes at the plant may be necessary to assure routine permit compliance.

Priority Pollutants - Water Samples

Very few organic priority pollutants were detected in the Snoqualmie samples (Table 15). Volatile organics (VOAs) detected in the effluent included methylene chlorine and acetone, both solvents used in sampling equipment clean-up. The configuration of the effluent sampling area did not allow VOA sample bottles to be filled directly. Solvent residual on the sampling equipment used was the likely source of these two compounds. Several semi-volatile compounds (BNAs) were detected in the influent, but all were below reliable quantification limits in the effluent. A complete list of priority pollutant scan target compounds and detection limits is included in Appendix A.

Compounds tentatively identified with the scan are noted in Appendix B. Concentrations in the effluent were lower than concentrations noted in the influent.

Several metals were detected (Table 15). Zinc exceeded chronic toxicity criteria in the four Ecology effluent composite samples collected. Metals exceeding chronic and acute toxicity criteria in one or more effluent sample include cadmium, copper, silver, and zinc.

Bioassays - Water

Effluent toxicity was minimal in the bioassays. All LC_{50}s, NOECs, and LOECs calculated were greater than 100 percent effluent (Table 16).

Sludge

The sludge sample was a composite of grab samples taken at eight stations in the lagoon. Sludge deposition of 0.5 to 1.0 foot was observed at the stations sampled (Figure 2). The samples were collected using an Isco composite sampler. The sampler intake was held in the sludge and the pump run to collect sludge in the sampling line. The pump was reversed and the sludge was flushed from the sampling line into the sampling container.

Few organic priority pollutants were detected in the sludge sample (Table 15). Bis(2-Ethylhexyl)phthalate was the organic found in the highest concentration (41000 μg/Kg dry wt). Snoqualmie sludge metals concentrations were fairly low, most falling below the geometric mean of samples collected during previous Class II Inspections at activated sludge plants in Washington (Table 15; Hallinan, 1988). A complete list of priority pollutant scan target compounds and detection limits is included in Appendix C. Compounds tentatively identified in the scan are noted in Appendix D.

Laboratory Procedure Review/Sample Splits

Laboratory procedures at the plant needed improvement. A new laboratory/office trailer had recently been stationed at the facility. The operator was not completely familiar with proper procedures. Arrangements were made with Mike Myers, an Ecology roving operator, to help teach the operator approved procedures. A "Laboratory Procedure Review Sheet" is included in Appendix E.

Split sample results comparison is of limited value (Table 17). The operators TSS results were considerably lower (275 mg/L and 55 mg/L) than the corresponding Ecology results (360 mg/L and 150 mg/L). Ecology laboratory problems allowed comparison of only one of four BOD_5 splits; Ecology result 56 mg/L, operator result 44 mg/L. A difference was noted in Ecology TSS results for the Ecology effluent (80 mg/L) and STP effluent (150 mg/L) samples. The Snoqualmie effluent sampler should be inspected to assure a representative sample is being collected.

There was a difference between the Ecology chlorine residual measurement (0.5 mg/L) and operator measurement (0.2 mg/L). The operator was using the ortho-tolidine method; a method which is not approved. A Standard Methods approved method should be used (APHA, 1985).

RECOMMENDATIONS AND CONCLUSIONS

Flow Measurement

The effluent flowmeter appeared to be accurate. After an obstruction was removed from the line near the influent meter; it appeared to measure accurately. The influent flume should be occassionally checked and cleared of debris as necessary.

Conventional Parameters/NPDES Permit Compliance

The plant was providing good nitrogen removal. Effluent BOD_5 and TSS concentrations appeared to be at or slightly above monthly permit limits. Operational or physical changes at the plant may be necessary to assure routine permit compliance.

Priority Pollutants - Water Samples

Few organics were detected. Those detected were found at low concentrations. Effluent concentrations of several metals exceeded freshwater toxicity criteria.

Bioassays - Water

Effluent toxicity was minimal.

Sludge

Few organics were detected. Most metals concentrations fell below statewide historical averages.

Laboratory Procedure Review/Sample Splits

Laboratory techniques needed improvement. Mike Myers, an Ecology roving operator, agreed to provide training. The Snoqualmie effluent sampler should be checked to assure it collects representative samples. Also, an approved chlorine residual test should be used.

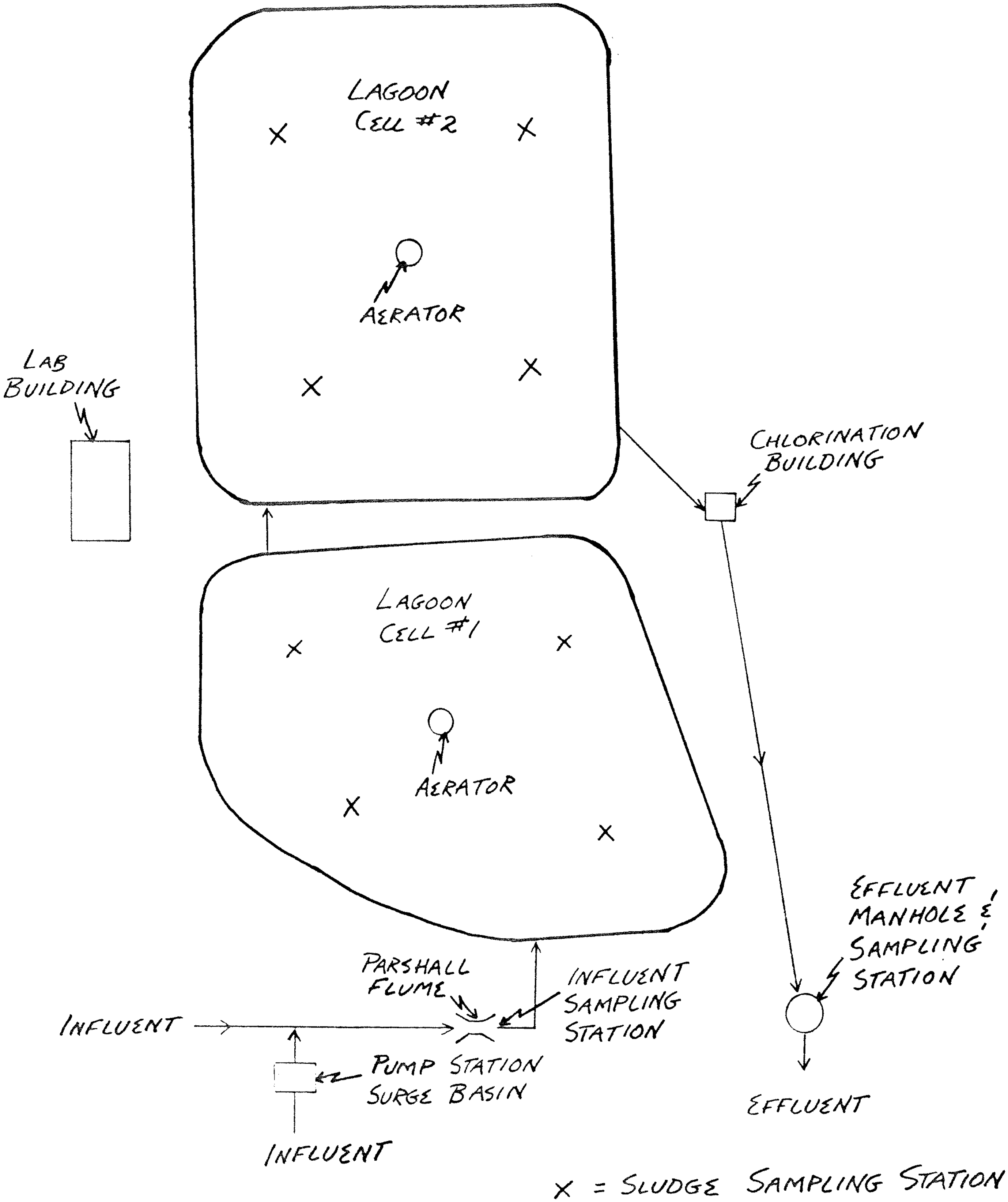

Figure 2. Snoqualmie STP Flow Scheme - SRD, 1989.

Table 11. Snoqualmie STP Sample Collection - SRD, 1989.

	7/25-26				8/15-16				9/5-6								
Lab Log- : Numbers :	308092	308093		308091	338421	338422		338417	368230 368231	368238		368239					
Sample:	Effluent	Effluent	Effluent	ECO- Ef	Effluent	Effluent	Effluent	ECO- Ef	Blank	Influent	Influent	Influent	Weyco Influent	Town Influent	Falls Influent	Influent	Influent
Date:	7/25	7/25	7/26	7/25-26	8/15	8/15	8/16	8/15-16	9/5	9/5	9/5	9/5	9/5	9/5	9/5	9/6	9/6
Time:	1045	1515	1130	1100-1100	0905	1430	0940	0915- **	0910	0920	0930	1350	1430	1430	1430	0925	0930
Type:	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Composite		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Field Analyses																	
pH	E	E	E	E	E	E	E	E		E	E	E	E	E	E	E	E
Temperature	E	E	E	E	E	E	E	E		E	E	E	E	E	E	E	E
Conductivity	E	E	E	E	E	E	E	E		E	E	E	E	E	E	E	E
Chlorine Residual																	
Total	E	E			E	E	E										
Free	E	E			E	E	E										
Laboratory Analyses																	
Turbidity				E				E									
Conductivity				E				E									
Alkalinity				E				E									
Hardness				E				E									
Chloride				E				E									
Cyanide																	
TS				E				E									
TNVS				E				E									
TSS				E				E									
TNVSS				E				E									
BOD_5				E				E									
Inhib. BOD_5																	
COD				E				E									
TOC																	
NH_3-N				E				E									
NO_3+NO_2-N				E				E									
Total-P				E				E									
Ortho-P				E				E									
% Solids																	
Fecal Coliform	E	E			E	E											
pp metals				E				E	E								
BNA									E								
VOA									E	E		E					
Pest/PCB									E								
Trout																	
Fathead Minnow																	
Ceriodaphnia dubia																	

Table 11. (Continued) - SRD, 1989.

	9/5-6									9/26-27									
Lab Log- :	368232	368234	368240	368242	368244		368235	368237	368245							398180	398181		398190
Numbers :	368233		368241	368243			368236		368246	Weyco	Weyco	Town	Town	Falls	Falls				
Sample:	ECO-Inf	STP-Inf	Effluent	Effluent	Ef- Dup	Effluent	ECO- Ef	STP-Ef	Sludge	Influent	Influent	Influent	Influent	Influent	Influent	Effluent	Effluent	Effluent	ECO- Ef
Date:	9/5-6	9/5-6	9/5	9/5	9/5	9/6	9/5-6	9/5-6	9/6	9/26	9/26	9/26	9/26	9/26	9/26	9/26	9/26	9/27	9/26-27
Time:	0930-0930	0800-0800	1005	1415	1415	1005	1000-1000	0800-0800	1545-1700	1428	1434	1425	1432	1420	1430	0915	1410	1030	0915-0915
Type:	Composite	Composite	Grab	Grab	Grab	Grab	Composite	Composite	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Composite
Field Analyses																			
pH	E	E	E	E		E	E	E		E	E	E	E	E	E	E	E	E	E
Temperature	E	E	E	E		E	E	E		E	E	E	E	E	E	E	E	E	E
Conductivity	E	E	E	E		E	E	E		E	E	E	E	E	E	E	E	E	E
Chlorine Residual																			
Total			E	E S		E										E	E	E	
Free			E	E		E										E	E	E	
Laboratory Analyses																			
Turbidity	E	E	E	E	E		E	E											E
Conductivity	E	E	E	E	E		E	E											E
Alkalinity	E	E	E	E	E		E	E											E
Hardness	E	E	E	E	E		E	E											E
Chloride	E	E	E	E	E		E	E											E
Cyanide	E						E												
TS	E	E					E	E											E
TNVS	E	E					E	E											E
TSS	E	E S	E	E	E		E	E S											E
TNVSS	E	E					E	E											E
BOD_5	E S	E S					E S	E S											E
Inhib. BOD_5	E						E												
COD	E	E	E	E	E		E	E											E
TOC									E										
NH_3-N	E	E	E	E	E		E	E											E
NO_3+NO_2-N	E	E	E	E	E		E	E											E
Total-P	E	E	E	E	E		E	E											E
Ortho-P	E	E	E	E	E		E	E											E
% Solids									E										
Fecal Coliform			E	E S	E											E	E		
pp metals	E						E		E										E
BNA	E						E		E										
VOA			E	E					E										
Pest/PCB	E						E		E										
Trout							E*												
Fathead Minnow							E*												
Ceriodaphnia dubia							E*												

* - Bioassay samples were hand composites made by mixing equal volumes of the 9/5-1005, 9/5-1415, and 9/6-1005 effluent grab samples.
** - The compositor failed during the sampling period. The first 17 aliquots were collected as equal volumes every thirty minutes. An 18th aliquot that was equal in volume to the sum of the previous 17 was added at 0925 on 8/16.
E - Ecology Laboratory Analysis.
S - Sewage Treatment Plant Laboratory Analysis.

Table 12. Snoqualmie STP Flow Measurements - SRD, 1989.

Average Daily Flows +

Date	Influent Flow (MGD)	Effluent Flow (MGD)
7/25-26	0.40 ++	0.14 *
8/15-16	1.15 ++	0.17 *
9/5-6	0.41 ++	0.23 **
9/26-27	0.22	0.23 **

\+ Influent measurements were made at a 3-inch Parshall flume. Effluent measurements were made at a 9-inch rectangular weir. Both meters were recalibrated 9/5/89.
++ Poor agreement between the influent and effluent flow rates was thought to be caused by a grease chunk lodged near the influent Parshall flume. The operator found and removed the chunk just before the 9/26-27 sampling.
* Average of Ecology instantaneous measurements
** Measurement from Snoqualmie STP effluent meter totalizer

Instantaneous Effluent Flow Measurements *

		Snoqualmie Meter		Ecology Measurement	
Date	Time	Head(ft)	Flow(MGD)	Head(ft)	Flow(MGD)
7/25	1515	0.17	0.11	0.20	0.14
7/26	1130	0.23	0.17	0.21	0.15
8/15	905	meter broken		0.22	0.16
8/15	1430	meter broken		0.23	0.17
8/16	940	meter broken		0.23	0.17
9/5	1025			0.24	0.18
9/5	1430	0.38	0.34	0.35	0.30
9/6	1005	0.32	0.27	0.30	0.24
9/26	905	0.28	0.22	0.25	0.19
9/26	1410	0.28	0.22	0.25	0.19
9/27	1035	0.31	0.25	0.28	0.22

* Staff gauges and flowmeters for the influent flume and effluent weir were accurate. Plant meter instantaneous flow readouts are in gallons per second.

Table 13. Snoqualmie STP - Ecology Laboratory Results-SRD, 1989.

	7/25-26				8/15-16				9/5-6								
Lab Log- :	308092	308093		308091	338421	338422		338417	368230	368238		368239					
Numbers :									368231								
Sample:	Effluent	Effluent	Effluent	ECO- Ef	Effluent	Effluent	Effluent	ECO- Ef	Blank	Influent	Influent	Influent	Weyco Influent	Town Influent	Falls Influent	Influent	Influent
Date:	7/25	7/25	7/26	7/25-26	8/15	8/15	8/16	8/15-16	9/5	9/5	9/5	9/5	9/5	9/5	9/5	9/6	9/6
Time:	1045	1515	1130	1100-1100	0905	1430	0940	0915- **	0910	0920	0930	1350	1430	1430	1430	0925	0930
Type:	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Composite		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Field Analyses																	
pH (S.U.)	7.4	7.6	7.8	7.5	7.1	7.1	7.3	7.5		9.7	7.9	7.5	7.2	7.5	7.5	11.3	8.8
Temperature (°C)	27.7	21.1	24.2	7.5	19.7	20.5	19.4	9.2		21.4	17.1	18.0	16.9	17.3	17.8	24.7	21.5
Conductivity (umhos/cm)	335	335	330	340	347	355	348	345		304	390	541	148	558	475	1300	355
Chlorine Residual (mg/L)																	
Total	1.0	1.2			1.1	1.2	1.2										
Free	0.2	0.1			<0.1	<0.1	<0.1										
Laboratory Analyses																	
Turbidity (NTU)				20				19									
Conductivity (umhos/cm)				327				353									
Alkalinity (mg/L $CaCO_3$)				100				83									
Hardness (mg/L $CaCO_3$)				50				55									
Chloride (mg/L)				32.9				30.5									
Cyanide (μg/L)																	
TS (mg/L)				310				350									
TNVS (mg/L)				150				190									
TSS (mg/L)				78				78									
TNVSS (mg/L)				20				14									
BOD_5 (mg/L)				42 J				23 J									
Inhib. BOD_5 (mg/L)																	
COD (mg/L)				138				158									
TOC (mg/gm dry-wt)																	
NH_3-N (mg/L)				1.9				0.48 J									
NO_3+NO_2-N (mg/L)				0.59				3.4 J									
Total-P (mg/L)				4.9				5.8 J									
Ortho-P (mg/L)				2.8 J				3.4 J									
% Solids																	
Fecal Coliform (#/100mL)	3 U	3 U			26	17											
Antimony (μg/L)				2.0 U				3.0 U	3.0 U								
Arsenic (μg/L)				1.0 U				1.0 UR	1.0 UR								
Beryllium (μg/L)				2.0 U				2.0 U	2.0 U								
Cadmium (μg/L)				5.0 U				6.9	5.0 U								
Chromium (μg/L)				5.0 U				6.0	5.0 U								
Copper (μg/L)				20				30	4.0 U								
Lead (μg/L)				3.8 B				3.8	1.0 U								
Mercury (μg/L)				0.06 U				0.06 U	0.06 U								
Nickel (μg/L)				20 U				20 U	20 U								
Selenium (μg/L)				2.0 U				2.0 U	2.0 U								
Silver (μg/L)				0.50 U				2.2	0.50 U								
Thallium (μg/L)				1.0 U				2.0 U	1.0 U								
Zinc (μg/L)				72.9 B				39.3 B	4.9 B								

** The compositor failed during the sampling period. The first 17 aliquots were collected as equal volumes every 30 minutes. An 18th aliquot that was equal in volume to the sum of the previous 17 was added at 0925 on 8/16.

U indicates compound was analyzed for but not detected at the given detection limit.

J indicates an estimated value.

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.

UJ indicates compound was analyzed for but not detected at the given detection limit, and the internal standard on which detection limit quantification was based was outside acceptance limits.

NR requested but not analyzed

UR indicates compound was analyzed for but not detected at the given detection limit, and the spike recovery was low so the actual detection limit may be higher.

BOF bottle over filled.

Table 13. (Continued) - SRD, 1989.

	9/5-6									9/26-27									
Lab Log-: Numbers:	368232 368233	368234	368240 368241	368242 368243	368244		368235 368236	368237	368245 368246							398180	398181		398190
Sample:	ECO-Inf	STP-Inf	Effluent	Effluent	Ef- Dup	Effluent	ECO- Ef	STP-Ef	Sludge	Weyco Influent	Weyco Influent	Town Influent	Town Influent	Falls Influent	Falls Influent	Effluent	Effluent	Effluent	ECO- Ef
Date:	9/5-6	9/5-6	9/5	9/5	9/5	9/6	9/5-6	9/5-6	9/6	9/26	9/26	9/26	9/26	9/26	9/26	9/26	9/26	9/27	9/26-27
Time:	0930-0930	0800-0800	1005	1415	1415	1005	1000-1000	0800-0800	1545-1700	1428	1434	1425	1432	1420	1430	0915	1410	1030	0915-0915
Type:	Composite	Composite	Grab	Grab	Grab	Grab	Composite	Composite	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Composite
Field Analyses																			
pH (S.U.)	7.7	9.9	7.6	7.7		7.8	7.8	7.6		7.3	7.4	7.9	7.9	7.3	7.8	7.4	7.4	7.5	7.8
Temperature (°C)	6.9	17.9	17.9	20.1		17.7	6.7	14.6		16.1	16.1	17.6	17.4	25.0	23.5	17.2	17.9	17.1	4.5
Conductivity (umhos/cm)	428	582	318	324		341	311	318		180	166	625	630	463	450	318	336	325	320
Chlorine Residual (mg/L)																			
Total			0.8	0.5		1.0										0.6	0.6	0.6	
Free			0.1	<0.1		<0.1										<0.1	<0.1	<0.1	
Laboratory Analyses																			
Turbidity (NTU)	49	230	17	17	18		17	24											18
Conductivity (umhos/cm)	441	614	342	342	342		343	348											349
Alkalinity (mg/L $CaCO_3$)	158	264	88	88	87		87	88											89
Hardness (mg/L $CaCO_3$)	65	48	52	51	50		57	52											51
Chloride (mg/L)	23.4	25.8	20.9	25.8	24.4		28.2	23.3											30.2
Cyanide (µg/L)	<4						<4												
TS (mg/L)	280	750					270	290											350
TNVS (mg/L)	85	79					110	66											180
TSS (mg/L)	140	360	54	96	120		80	150											44
TNVSS (mg/L)	14	38					9	12											1 U
BOD_5 (mg/L)	NR	>60					NR	56 J											21
Inhib. BOD_5 (mg/L)	>20						24												
COD (mg/L)	406	1240	185	199	211		99	251											169
TOC (mg/gm dry-wt)									140										
NH_3-N (mg/L)	15	9.6	0.24	0.26	0.23		0.51	0.41											0.55
NO_3+NO_2-N (mg/L)	0.59	0.40	2.6	2.8	2.7		2.9	2.9											2.5
Total-P (mg/L)	8.4	6.5	6.0	5.2	5.1		6.0	7.0											7.1
Ortho-P (mg/L)	3.6	3.0	3.4	3.2	3.2		3.2	3.4											3.7
% Solids									6.5										
Fecal Coliform (#/100mL)			3	23	BOF 10 U				(mg/Kg dry wt)							29	11		
Antimony (µg/L)	3.0 U						3.0 U		0.06 UJ										3.0 U
Arsenic (µg/L)	1.0 UR						1.0 UR		40										1.0 UR
Beryllium (µg/L)	2.0 U						2.0 U		0.17 J										2.0 U
Cadmium (µg/L)	5.0 U						5.0 U		4.8 J										5.0 U
Chromium (µg/L)	12						5.0 U		42.0										5.0 U
Copper (µg/L)	136						20		637										20
Lead (µg/L)	10.1 B						2.9 B		120										2.8 B
Mercury (µg/L)	0.08						0.06 U		98										0.06 U
Nickel (µg/L)	20 U						20 U		21 J										20 U
Selenium (µg/L)	2.0 U						2.0 U		0.024 J										2.0 U
Silver (µg/L)	0.50 U						0.50 U		54.3										0.50 U
Thallium (µg/L)	1.0 U						1.0 U		0.020 U										1.0 U
Zinc (µg/L)	134 B						30.4 B		1150										29.6 B

Table 14. Snoqualmie STP-Comparison of Inspection Results with NPDES Permit Limits-SRD, 1989.

Parameter *	NPDES Permit Limits Monthly Average	NPDES Permit Limits Weekly Average	7/25-26 Ecology Samples	8/15-16 Ecology Samples	9/5-6 Ecology Samples	9/5-6 STP Samples	9/26-27 Ecology Samples
BOD_5							
(mg/L)	30	45	42 J	23 J	NR	56 J	21
(lbs/D)	51	76	49	33		107	40
(% removal)	85				**	**	
TSS							
(mg/L)	75	110	78	78	80	150	44
(lbs/D)	163	239	91	111	153	288	84
Fecal coliform (#/100 mL)	200	400	3 U 3 U	26 17	3 23 BOF 10 U		29 11
pH (S.U.)	shall not be outside the range 6.0 - 9.0		7.4,7.6,7.8	7.1,7.1,7.3	7.6,7.7,7.8		7.4,7.4,7.5
Flow (MGD)			0.14	0.17	0.23	0.23	0.23

* Ecology analytical results - composite samples for BOD_5 and TSS, grab samples for pH and fecal coliforms.
** cannot be calculated due to unreliable influent analysis
J estimated
NR requested but not analyzed
BOF bottle overfilled
U less than

Table 15. Snoqualmie STP-Priority Pollutants Detected and Toxicity Criteria Comparison - SRD, 1989.

	Transfer Blk	Snoqualmie Influent		Snoqualmie Sludge
Lab Log #:	368231	368238	368239	368246
Type:		Grab	Grab	
Date:	9/5	9/5	9/5	9/6
Time:	0910	0920	1350	1545-1700
% Solids				6.5
TOC (% dry wt basis)				14
VOA Compounds	(μg/L)	(μg/L)	(μg/L)	(μg/Kg dry wt)
Methylene Chloride	-	-	-	-
Acetone	-	22 J	17	-
Carbon Disulfide	-	-	-	17 J
Chloroform	-	6	3 J	-
Toluene	-	2 J	4 J	-
Chlorobenzene	-	-	-	100
Styrene	-	-	-	21 J
Total Xylenes	-	-	2 J	19 J

	Transfer Blk	Snoqualmie Influent	Snoqualmie Sludge
Lab Log #:	368231	368233	368246
Type:		ECO-Comp	9/6
Date:	9/5	9/5-6	1545-1700
BNA Compounds	(μg/L)	(μg/L)	(μg/Kg dry wt)
Phenol	-	3 J	-
1,4-Dichlorobenzene	-	3 J	-
Benzyl Alcohol	-	22	-
4-Methylphenol	-	17	-
Benzoic Acid	-	62	5300 J
Dimethyl Phthalate	-	1 J	-
Diethyl Phthalate	-	6 J	1600 J
Phenanthrene	-	-	940 J
Pyrene	-	-	900 J
Bis(2-Ethylhexyl)phthalate	-	27	41000
Di-n-Octyl Phthalate	-	2 J	-
Total Phthalate Esters			
Pest/PCB Compounds			
Endosulfan Sulfate	-	-	210 J
4,4'-DDT	-	0.065 J	-

	Transfer Blk	Snoqualmie Influent	Snoqualmie Sludge	Statewide Class II Sludge Data ***		
Lab Log #:	368231	368233	368245	Geometric		#
Type:		ECO-Comp	9/6	Mean	Range	Sampled
Date:	9/5	9/5-6	1545-1700			
Metals	(μg/L)	(μg/L)	(mg/Kg dry wt)	(mg/Kg dry wt)		
Arsenic	-	-	40			
Beryllium	-	-	0.17 J			
Cadmium	-	-	4.8 J	7.6	<0.1-25	34
Chromium	-	12	42.0	62	15-300	34
Copper	-	136	637	400	75-1700	34
Lead	-	10.1 B	120	210	34-600	34
Mercury	-	0.08	98			
Nickel	-	-	21 J	26	<0.1-62	29
Selenium	-	-	0.024 J			
Silver	-	-	54.3			
Zinc	4.9 B	134 B	1150	1200	165-3370	33

Table 15. (Continued) - SRD, 1989.

	Snoqualmie Effluent		Freshwater Toxicity Criteria (EPA, 1986b)	
Lab Log #:	368241	368243		
Type:	Grab	Grab		
Date:	9/5	9/5		
Time:	1005	1415	Acute	Chronic
% Solids				
TOC (% dry wt basis)				
VOA Compounds	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Methylene Chloride	80	55		
Acetone	590 DJ	860 J		
Carbon Disulfide	-	-		
Chloroform	8	9 J	28900*	1240*
Toluene	2 J	-	17500*	
Chlorobenzene	-	-		
Styrene	-	-		
Total Xylenes	-	-		

		Freshwater Toxicity Criteria (EPA, 1986b)	
Lab Log #:	368235		
Type:	ECO-Comp		
Date:	9/5-6	Acute	Chronic
BNA Compounds	(µg/L)		
Phenol	-		
1,4-Dichlorobenzene	-		
Benzyl Alcohol	-		
4-Methylphenol	-		
Benzoic Acid	-		
Dimethyl Phthalate	-		
Diethyl Phthalate	-		
Phenanthrene	-		
Pyrene	-		
Bis(2-Ethylhexyl)phthalate	3 J		
Di-n-Octyl Phthalate	-		
Total Phthalate Esters	3 J	940*	3*
Pest/PCB Compounds			
Endosulfan Sulfate	-		
4,4'-DDT	-		

					Freshwater Toxicity Criteria (EPA, 1986b)	
Lab Log #:	368235	308091	338417	398190		
Type:	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp		
Date:	9/5-6	7/25-26	8/15-16	9/26-27	Acute	Chronic
Metals	(µg/L)	(µg/L)	(µg/L)	(µg/L)		
Arsenic	-	-	-	-		
Beryllium	-	-	-	-		
Cadmium	-	-	6.9	-	2.0 +	0.7+
Chromium	-	-	6.0	-	1048(16) *+	125(11)*+
Copper	20	20	30	20	10 +	7+
Lead	2.9 B	3.8 B	3.8	2.8 B	37 +	1.5+
Mercury	-	-	-	-		
Nickel	-	-	-	-		
Selenium	-	-	-	-		
Silver	-	-	2.2	-	1.4 +	0.12
Zinc	30.4 B	72.9 B	39.3 B	29.6 B	69 +	63+

J indicates an estimated value when result is less than specified detection limit
B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination
D value from analysis of a diluted sample
DJ comment D plus comment J
* insufficient data to develop criteria - Lowest Observed Effect Level (LOEL) presented
*** summary of data collected during previous Class II Inspections statewide at activated sludge plants (Hallinan, 1988)
\+ calculation based on hardness (54 mg/L)
*+ Tri(Hex) - Tri based on hardness

Table 16. Snoqualmie STP Effluent Bioassay Results - SRD 1989.

Rainbow Trout (*Oncorhynchus mykiss*) - 96 hour survival test

Sample	# Tested	# Survived	Percent Mortality	Percent Survival
Control	20	20	0	100
6.25 % Effluent	20	20	0	100
12.5 % Effluent	20	20	0	100
25.0 % Effluent	20	18	10	90
50.0 % Effluent	20	19	5	95
100 % Effluent	20	14	30	70
		96 hour LC_{50} > 100% effluent		

Ceriodaphnia dubia - 48 hour survival and 7 day reproduction test

		after 48 hours			after 7 days			
Sample	# Tested	# Survived	Percent Mortality	Percent Survival	# Survived	Percent Mortality	Percent Survival	Mean # Young per Original Female
Control	10	9	10	90	9	10	90	18.0
6.25 % Effluent	10	9	10	90	9	10	90	20.8
12.5 % Effluent	10	8	20	80	8	20	80	16.1
25.0 % Effluent	10	10	0	100	9	10	90	18.7
50.0 % Effluent	10	8	20	80	8	20	80	18.3
100 % Effluent	10	8	20	80	8	20	80	15.8
		48 hr LC_{50} > 100% effluent				NOEC > 100% effluent		
						LOEC N/A		

Table 16. (Continued)- SRD, 1989.

Fathead Minnow (*Pimephales promelas*) - 96 hour survival and 7 day growth test

		after 96 hours			after 7 days			
Sample	# Tested	# Survived	Percent Mortality	Percent Survival	# Survived	Percent Mortality	Percent Survival	Mean Weight per Fish (mg)
Control	30	24	20	80	18	40	60	0.29
6.25 % Effluent	30	27	10	90	17	43	57	0.33
12.5 % Effluent	30	27	10	90	19	37	63	0.37
25.0 % Effluent	30	28	7	93	22	27	73	0.36
50.0 % Effluent	30	23	23	77	21	30	70	0.27
100 % Effluent	30	25	17	83	16	47	53	0.24

96 hr LC_{50} > 100% effluent

NOEC not calculated due to high control mortality.
LOEC not calculated due to high control mortality.

NOEC - no observable effects concentration
LOEC - lowest observable effects concentration
LC_{50} - lethal concentration for 50% of the organisms
EC_{50} - effect concentration for 50% of the organisms

Table 17 - Snoqualmie STP - Split Sample Results Comparison - SRD, 1989.

Parameter	Laboratory	Lab Log-: Numbers:	368232 368233	368234	368242 368243	368235 368236	368237
		Sample:	ECO-Inf	STP-Inf	Effluent	ECO-Ef	STP-Ef
		Date:	9/5-6	9/5-6	9/5	9/5-6	9/5-6
		Time:	0930-0930	0800-0800	1415	1000-1000	0800-0800
		Type:	Composite	Composite	Grab	Composite	Composite
Total Chlorine Residual (mg/L)	Ecology				0.5		
	Snoqualmie				0.2		
TSS (mg/L)	Ecology		140	360		80	150
	Snoqualmie			275			55
BOD5 (mg/L)	Ecology		LAC	LAC		LAC	56
	Snoqualmie		650	680		43	44
Fecal Coliform (#/100 mL)	Ecology				10 U & 23 BOF		
	Snoqualmie				0		

LAC laboratory accident
BOF Bottle overfilled
U less than

DUVALL

SETTING

The Duvall STP is an oxidation ditch type secondary plant (Figure 3). Design monthly average flow is 0.2 MGD. Both oxidation ditches and both secondary clarifiers were operating during all visits. On July 25-26, and on September 5-6, one chlorine contact chamber was being operated. On August 15-16, and September 26-27, both chlorine contact chambers were being operated. Flow was measured at an effluent Parshall flume.

Waste sludge disposal was difficult. There were no means of holding or thickening waste sludge. Return activated sludge was wasted directly into a 900 gallon tank truck for land application on one of three local sites.

Dean Castinelli was plant operator during the first sampling date. The city elected not to retain him at the end of his probationary period. John Light, supervisor of public works and previous plant operator, assumed the operator duties during the remainder of the visits as a new operator was sought.

Samples collected, sampling times, and parameters analyzed are summarized in Table 18. Sample locations are illustrated in Figure 3.

RESULTS AND DISCUSSION

Flow Measurement

Flow measurements were being made at the effluent 6-inch Parshall flume (Table 19). Ecology instantaneous measurements made at the flume corresponded closely with the plant meter instantaneous flow measurements. The flowmeter appeared to be measuring accurately during the inspections.

Conventional Parameters/NPDES Permit Compliance

Visual differences were apparent during the series of visits at the Duvall STP. During the July 25-26 visits, containment of solids in the plant was a problem. Sludge was observed billowing over the clarifier launder weirs and the chlorine contact chamber weir during both morning visits. The operator was attempting to maximize sludge wasting, but was frustrated by the lack of sludge thickening facilities. The afternoon visit found the plant keeping solids in, but sludge was settling poorly suggesting another washout would likely occur.

During the August 15-16 visits, the plant appeared to have experienced a recent toxic upset. The oxidation ditches were a gray color and the effluent had the appearance of primary effluent. John Light was in his first full week of plant operation and was unsure what had happened. Chlorine addition to the oxidation ditches had been used in an effort to discourage filamentous growth and encourage settling. He theorized that excess chlorine had been added during the operator transition time the previous week. The operator detected a chlorine residual in the oxidation ditch, although the Ecology test found no residual in the oxidation ditch or clarifier overflow.

The September 5-6 and September 26-27 visits found the plant returning to conditions similar to that of the July 25-26 inspection. Solids losses and poor settling in the clarifiers were observed.

Samples collected during the first visit indicated some nitrification was occurring; the effluent NH_3-N concentration was 1.3 mg/L (Table 20). Nitrification was not occurring during the last three visits; effluent NH_3-N concentrations 9.7 mg/L or more. The nitrifying organisms may have been lost during the August 15-16 upset. Maintaining reasonable clearwater depths in the secondary clarifiers was consistently accomplished only during the upset visit on August 15-16 (Table 21). Solids accumulation in the chlorine contact chambers was also occurring.

Results comparison with NPDES permit effluent limits showed poor compliance during the visits (Table 22). The TSS exceeded weekly and monthly concentration and monthly loading limits during all the visits; and also exceeded the weekly loading limits during the two September visits. The fecal coliform concentrations were consistently higher than the permit limits. Poor Ecology laboratory BOD_5 analysis prevented good comparison of BOD_5 inspection results with the permit limits.

Priority Pollutants - Water Samples

Organics concentrations were low in the effluent sample (Table 23). The total phthalate esters concentration (23 μg/L-estimated) exceeded the chronic freshwater toxicity criteria: it was the only organic found in the effluent in excess of freshwater toxicity criteria (EPA, 1986b). Several organics were found in the influent sample. Benzoic acid (148 μg/L) was found at the highest concentration. Most of the compounds found in the influent were removed from the liquid stream during the treatment process. A complete list of priority pollutant scan target compounds and detection limits is included in Appendix A.

Compounds tentatively identified in the scan are noted in Appendix B. More compounds and higher concentrations were noted in the influent than in the effluent.

Several metals were detected in the effluent (Table 23). Metals exceeding only chronic toxicity criteria in one or more of the effluent metals samples include lead and mercury. Metals exceeding chronic and acute toxicity criteria in one or more of the effluent metals samples include copper, silver, and zinc.

Bioassays - Water

Some effluent toxicity was observed in the bioassays (Table 24). Acute toxicity was observed in both the rainbow trout (LC_{50} = 50% effluent) and fathead minnow (LC_{50} = 62% effluent) tests. Chronic toxicity was observed in the *Ceriodaphnia dubia* (NOEC = 25% effluent) and fathead minnow (NOEC = 50% effluent) tests.

Several metals were noted in concentrations greater than toxicity criteria (see priority pollutants - water). The effluent NH_3-N concentration was 19 mg/L-estimated which exceeded acute and chronic toxicity criteria for the test conditions (trout test conditions: chronic criteria 1.7 mg/L NH_3-N, acute criteria 8.7 mg/L NH_3-N; *Ceriodaphnia dubia* test conditions: chronic criteria 1.1 mg/L NH_3-N, acute criteria 8.4 mg/L NH_3-N; fathead minnow test conditions: chronic criteria 1.2 mg/L NH3-N, acute criteria 15.6 mg/L NH_3-N).

Sludge

Few organic priority pollutants were detected in the sludge sample (Table 23). Bis(2-Ethylhexyl)phthalate was the organic found in the highest concentration (150 μg/L). Duvall sludge metals concentrations were less than the geometric means for samples collected during previous Class II Inspections at activated sludge plants in Washington (Table 23; Hallinan, 1988).

A complete list of priority pollutant scan target compounds and detection limits is included in Appendix C. Compounds tentatively identified in the scan are noted in Appendix D.

Laboratory Procedure Review/Sample Splits

Laboratory and sampling procedures at the plant were generally acceptable. Minor recommendations are included in the "Laboratory Procedure Review Sheet" included in Appendix E.

The split samples results comparison was good for TSS and chlorine residual (Table 25). Poor Ecology laboratory analysis of BOD_5 prevented results comparison for the parameter. The Duvall fecal coliform result (1800/100mL) was lower than the Ecology result (24000/100mL-estimated) by an order of magnitude. The Duvall plate count was high, suggesting a greater dilution factor is necessary for a more accurate count.

RECOMMENDATIONS AND CONCLUSIONS

Flow Measurement

The flowmeter appeared to be measuring accurately during the inspection.

Conventional Parameters/NPDES Permit Compliance

Solids loss was a problem during the inspections. Also, there was an apparent toxic upset in early August. Effluent TSS concentrations and loads, and fecal coliform concentrations frequently exceeded permit limits. Poor Ecology analysis of BOD_5 prevented good comparison of the parameter with permit limits.

Priority Pollutant - Water Samples

Effluent organic concentrations were low. Effluent concentrations of total Phthalate Esters and several metals exceeded freshwater toxicity criteria.

Bioassays - Water

Some acute and chronic toxicity was observed in the effluent. Ammonia or the priority pollutants observed in excess of the freshwater toxicity criteria are possible causes.

Sludge

Few organics were observed in the sludge. Metals concentrations fell below statewide historical averages.

Laboratory Procedure Review/Sample Splits

Analytical and sampling procedures were generally acceptable. Recommendations for minor changes are included in Appendix E. Greater dilution factors for fecal coliform testing are recommended when counts are as high as found during the inspection.

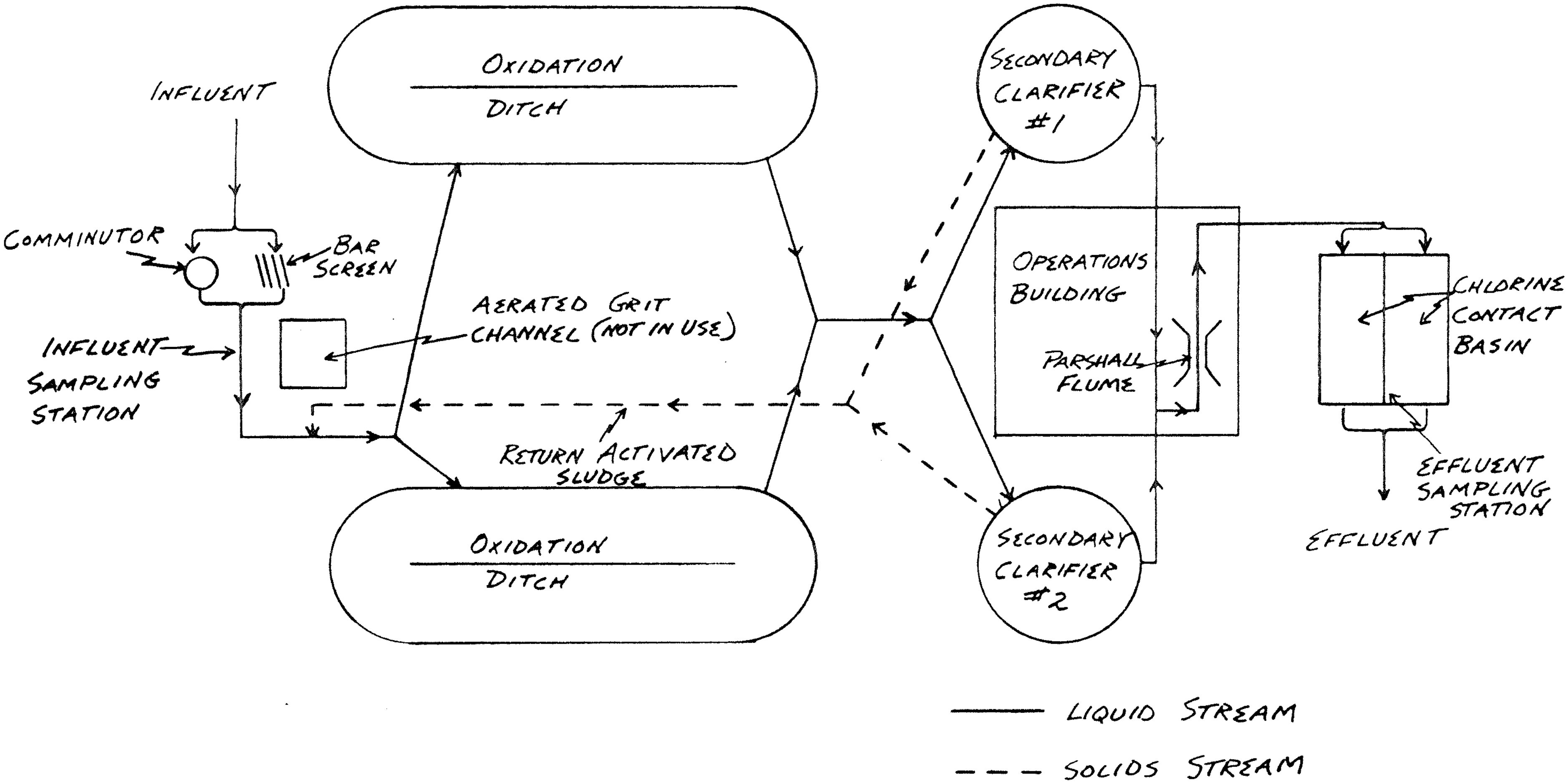

Figure 3. Duvall STP Flow Scheme - SRD, 1989.

Table 18. Duvall STP - Sample Collection - SRD, 1989.

	7/25-26				8/15-16												
Lab Log- :	308095	308096		308094	338400	338407	338408		338401	338403	338409	338411	338413		338404	338406	338414
Numbers :					338425				338402		338410	338412			338405		338415
Sample :	Effluent	Effluent	Effluent	ECO-Ef	Blank	Influent	Influent	Influent	ECO-Inf	STP-Inf	Effluent	Effluent	Ef-Dup	Effluent	ECO-Ef	STP-Ef	RAS
Date :	7/25	7/25	7/26	7/25-26	8/15	8/15	8/15	8/16	8/15-16	8/15-16	8/15	8/15	8/15	8/16	8/15-16	8/15-16	8/16
Time :	1150	1600	1400	1200-1200	1140	1125	1600	1130	1200-1200	1200-1200	1105	1540	1540	1115	1200-1200	1200-1200	1205
Type :	Grab	Grab	Grab	Composite		Grab	Grab	Grab	Composite	Composite	Grab	Grab	Grab	Grab	Composite	Composite	Grab
Field Analyses																	
pH	E	E	E	E		E	E	E	E	E	E	E		E	E	E	
Temperature	E	E	E	E		E	E	E	E	E	E	E		E	E	E	
Conductivity	E	E	E	E		E	E	E	E	E	E	E		E	E	E	
Chlorine Residual																	
Total	E	E	E								E	E		E			
Free	E	E	E								E	E		E			
Laboratory Analyses																	
Turbidity				E					E	E	E	E	E		E	E	
Conductivity				E					E	E	E	E	E		E	E	
Alkalinity				E					E	E	E	E	E		E	E	
Hardness				E					E	E	E	E	E		E	E	
Chloride				E					E	E	E	E	E		E	E	
Cyanide									E						E		
TS				E					E	E					E	E	
TNVS				E					E	E					E	E	
TSS				E					E S	E S	E	E	E		E S	E S	
TNVSS				E					E	E					E	E	
BOD_5				E					E S	E S					E S	E S	
Inhib. BOD_5									E						E		
COD				E					E	E	E	E	E		E	E	
TOC																	E
NH_3-N				E					E	E	E	E	E		E	E	
NO_3+NO_2-N				E					E	E	E	E	E		E	E	
Total-P				E					E	E	E	E	E		E	E	
Ortho-P				E					E	E	E	E	E		E	E	
% Solids																	E
Fecal Coliform	E	E									E	E	E				
pp metals				E	E				E						E		E
BNA					E				E						E		E
VOA					E	E	E				E	E					E
Pest/PCB					E				E						E		E
Trout															E*		
Fathead Minnow															E*		
Ceriodaphnia dubia															E*		

E - Ecology Laboratory Analysis
S - Sewage Treatment Plant Laboratory Analysis
* - Bioassay samples were hand composites made by mixing equal volumes of the three (8/15-1105, 8/15-1540, and 8/16-1115) effluent grab samples.

Table 18. (Continued) - SRD, 1989.

	9/5-6					9/26-27					
Lab Log- Numbers :		368252	368253		368248	398182	398188	398183		398191	398194
Sample :	Influent	Effluent	Effluent	Effluent	ECO-Ef	Effluent	Ef-Dup	Effluent	Effluent	ECO-Ef	ECO-Ef-Dup
Date :	9/6	9/5	9/5	9/6	9/5-6	9/26	9/26	9/26	9/27	9/26-27	9/26-27
Time :	1325	1130	1555	1300	1145-1145	1110	1110	1510	1130	1115-1115	1115-1115
Type :	Grab	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Grab	Composite	Composite
Field Analyses											
pH	E	E	E	E	E	E		E	E	E	
Temperature	E	E	E	E	E	E		E	E	E	
Conductivity	E	E	E	E	E	E		E	E	E	
Chlorine Residual											
Total		E S	E	E		E		E	E		
Free		E	E	E		E		E	E		
Laboratory Analyses											
Turbidity					E					E	E
Conductivity					E					E	E
Alkalinity					E					E	E
Hardness					E					E	E
Chloride					E					E	E
Cyanide											
TS					E					E	E
TNVS					E					E	E
TSS					E					E	E
TNVSS					E					E	E
BOD_5					E					E	E
Inhib. BOD_5					E						
COD					E					E	E
TOC											
NH_3-N					E					E	E
NO_3+NO_2-N					E					E	E
Total-P					E					E	E
Ortho-P					E					E	E
% Solids											
Fecal Coliform		E S	E			E	E	E			
pp metals					E					E	E
BNA											
VOA											
Pest/PCB											
Trout											
Fathead Minnow											
Ceriodaphnia dubia											

Table 19. Duvall STP - Flow Measurements - SRD, 1989.

Average Daily Flows

Date	Effluent * Flow (MGD)
7/25-26	0.147
8/15-16	0.152
9/5-6	0.165
9/26-27	0.147

* Measurements from Duvall STP effluent meter totalizer. Measurements made at a 6-inch Parshall flume.

Instantaneous Flow Measurements

		Duvall Effluent Flowmeter *	
Date	Time	Head(ft)	Flow(MGD)
7/25	1135	0.25	0.15
7/25	1610	0.27	0.17
8/15	1110	0.22	0.12
8/15	1530	0.17	0.08
8/16	1240	0.31	0.20
9/5	1130	0.35	0.25
9/5	1555	0.14	0.06
9/6	1430	0.17	0.08
9/26	1110	0.23	0.13
9/26	1510		0.24

* Effluent measurements made at a 6-inch Parshall flume. The staff gauge installed in the flume was checked by Ecology and found to be accurate. Occasional checks found the flow meter measuring accurately. Plant meter instantaneous flow readouts are in gallons per second.

Table 20. Duvall STP - Ecology Laboratory Results - SRD 1989.

	7/25-26				8/15-16												
Lab Log- : Numbers:	308095	308096		308094	338400 338425	338407	338408		338401 338402	338403	338409 338410	338411 338412	338413		338404 338405	338406	338414 338415
Sample:	Effluent	Effluent	Effluent	ECO- Ef	Blank	Influent	Influent	Influent	ECO-Inf	STP-Inf	Effluent	Effluent	Ef- Dup	Effluent	ECO- Ef	STP-Ef	RAS
Date:	7/25	7/25	7/26	7/25-26	8/15	8/15	8/15	8/16	8/15-16	8/15-16	8/15	8/15	8/15	8/16	8/15-16	8/15-16	8/16
Time:	1150	1600	1400	1200-1200	1140	1125	1600	1130	1200-1200	1200-1200	1105	1540	1540	1115	1200-1200	1200-1200	1205
Type:	Grab	Grab	Grab	Composite		Grab	Grab	Grab	Composite	Composite	Grab	Grab	Grab	Grab	Composite	Composite	Grab
Field Analyses																	
pH (S.U.)	7.2	7.2	7.3	7.4		8.5	9.1	8.6	8.7	8.5	7.4	7.4		7.5	7.9	7.9	
Temperature (°C)	19.7	21.2	21.1	6.7		19.5	19.5	19.7	7.2	8.9	18.4	19.4		18.5	6.2	7.0	
Conductivity (umhos/cm)	440	445	472	444		500	685	480	560	539	558	560		562	545	565	
Chlorine Residual (mg/L)																	
Total	1.3	0.7	<0.1								0.2	0.5		<0.1			
Free	0.4	<0.1	<0.1								<0.1	<0.1		<0.1			
Laboratory Analyses																	
Turbidity (NTU)				13					64	46	19	19	19		18	18	
Conductivity (umhos/cm)				428					615	597	557	558	555		569	566	
Alkalinity (mg/L $CaCO_3$)				108					201	201	187	185	185		182	178	
Hardness (mg/L $CaCO_3$)				41					41	43	30	33	38		39	34	
Chloride (mg/L)				40.4					35.7	28.7	35.2	34.7	35.0		35.8	37.0	
Cyanide (µg/L)									4						5		
TS (mg/L)				350					580	470					360	360	
TNVS (mg/L)				180					250	210					210	220	
TSS (mg/L)				50					180	150	38	36	37		54	47	
TNVSS (mg/L)				12					40	22					14	18	
BOD_5 (mg/L)				14J					LAC	240J					LAC	38J	
Inhib. BOD_5 (mg/L)									200J						43J		
COD (mg/L)				78					495	425	144	151	158		153	156	
TOC (mg/g dry wt)																	450
NH_3-N (mg/L)				1.3					21J	24J	18J	18J	18J		19J	20.4J	
NO_3+NO_2-N (mg/L)				0.66					0.14J	0.16J	0.12J	0.12J	<0.05J		<0.05J	1.4J	
Total-P (mg/L)				2.3					10J	11J	2.8J	3.2J	4.4J		5.9J	6.6J	
Ortho-P (mg/L)				2.6J					5.8J	5.5J	2.9J	2.8J	2.9J		4.4J	3.3J	
% Solids																	0.98
Fecal Coliform (#/100mL)	12000	29									27000JL	8400JL	9300JL				
Antimony (µg/L)				2.0 U	3.0 U				3.0 U						3.0 U		12 U
Arsenic (µg/L)				1.0 U	1.0 UR				1.9 R						1.7 R		18.9
Beryllium (µg/L)				2.0 U	2.0 U				2.0 U						2.0 U		1.0 U
Cadmium (µg/L)				5.0 U	5.0 U				5.0 U						5.0 U		23
Chromium (µg/L)				5.0 U	5.0 U				5.0						5.0 U		63
Copper (µg/L)				15	4.0 U				52.1						23		1320
Lead (µg/L)				3.6 B	12.9				10 B						4.3 B		180
Mercury (µg/L)				0.42	0.06 U				0.33						0.22		17.5
Nickel (µg/L)				20 U	20 U				20 U						20 U		89
Selenium (µg/L)				2.0 U	2.0 U				2.0 U						2.0 U		9.7 J
Silver (µg/L)				0.50 U	0.50 U				0.50 U						1.7		20.2
Thallium (µg/L)				1.0 U	1.0 U				2.0 U						2.0 U		4.0 U
Zinc (µg/L)				66.7 B	7.0 B				104 B						52.2 B		2550

Table 20. (Continued) - SRD, 1989.

	9/5-6					9/26-27					
Lab Log- Numbers:		368252	368253		368248	398182	398188	398183		398191	398194
Sample:	Influent	Effluent	Effluent	Effluent	ECO- Ef	Effluent	Ef-Dup	Effluent	Effluent	ECO- Ef	ECO-Ef-Dup
Date:	9/6	9/5	9/5	9/6	9/5-6	9/26	9/26	9/26	9/27	9/26-27	9/26-27
Time:	1325	1130	1555	1300	1145-1145	1110	1110	1510	1130	1115-1115	1115-1115
Type:	Grab	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Grab	Composite	Composite
Field Analyses											
pH (S.U.)	8.4	7.5	7.3	7.6	7.8	7.3		7.3	7.7	7.9	
Temperature (°C)	19.5	18.8	19.9	18.9	5.4	18.1		18.7	18.4	5.6	
Conductivity (umhos/cm)	445	478	494	485	510	448		484	496	467	
Chlorine Residual (mg/L)											
Total		0.6	0.3	0.7		0.6		1.2	0.3		
Free		0.2	0.1	<0.1		<0.1		<0.1	<0.1		
Laboratory Analyses											
Turbidity (NTU)					28					26	29
Conductivity (umhos/cm)					508					513	515
Alkalinity (mg/L CaCO3)					144					137	137
Hardness (mg/L $CaCO_3$)					37					39	40
Chloride (mg/L)					35.8					37.5	28.7
Cyanide (μg/L)											
TS (mg/L)					230					450	440
TNVS (mg/L)					150					230	200
TSS (mg/L)					140					110	92
TNVSS (mg/L)					31					4	1U
BOD_5 (mg/L)					NR					>22J	>85J
Inhib. BOD_5 (mg/L)					25						
COD (mg/L)					152					207	216
TOC (mg/g dry wt)											
NH_3-N (mg/L)					9.7					14	13
NO_3+NO_2-N (mg/L)					0.19					0.16	0.05
Total-P (mg/L)					11					16	16
Ortho-P (mg/L)					7.8					9.8	7.8
% Solids											
Fecal Coliform (#/100mL)		24000JL	75000JL			2000	1300	1800			
Antimony (μg/L)					3.0 U					3.0 U	3.0 U
Arsenic (μg/L)					1.0 UR					1.0 UR	1.0 UR
Beryllium (μg/L)					2.0 U					2.0 U	2.0 U
Cadmium (μg/L)					5.0 U					5.0 U	5.0 U
Chromium (μg/L)					5.0 U					5.0 U	5.0 U
Copper (μg/L)					26					28	28
Lead (μg/L)					3.9 B					3.9 B	3.6 B
Mercury (μg/L)					0.10					0.25	0.29
Nickel (μg/L)					20 U					20 U	20 U
Selenium (μg/L)					2.0 U					2.0 U	2.0 U
Silver (μg/L)					0.50 U					4.5	3.8
Thallium (μg/L)					1.0 U					1.0 U	1.0 U
Zinc (μg/L)					82.2					105	114

JL	estimated - total plate count greater than 200.
LAC	laboratory accident.
NR	requested but not analyzed.
U	indicates compound was analyzed for but not detected at the given detection limit.
J	indicates an estimated value.
B	This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.
R	low spike recovery - result may be biased low.
UR	indicates compound was analyzed for but not detected at the given detection limit, and the spike recovery was low so the actual detection limit may be higher.

Table 21. Duvall STP Sludge Depth Measurements - SRD, 1989.

Date	Time	Unit **	Tank Depth (ft)	Sludge Blanket Thickness (ft)	Poorly Settled Sludge Layer (ft)	Clear-water Depth (ft)
7/25	1200	Clarifier #1	8.5	0.0	8.5	0.0
		Clarifier #2	8.5	0.0	8.5	0.0
		Cl_2 Contact Basin *	7.0			
		near inlet		0.0	7.0	0.0
		near outlet		5.0	2.0	0.0
7/25	1620	Clarifier #1	8.5	2.0	5.0	1.5
		Clarifier #2	8.5	2.0	5.0	1.5
		Cl_2 Contact Basin *	7.0			
		near inlet		0.0		7.0
		half way		4.0		3.0
		near outlet		5.5		1.5
8/15	1145	Clarifier #1	8.5	1.5		7.0
		Clarifier #2	8.5	1.5		7.0
		Cl_2 Contact Basin *	7.0	2.0		5.0
8/15	1530	Clarifier #1	8.5	2.0		6.5
		Clarifier #2	8.5	2.0		6.5
		Cl_2 Contact Basin *	7.0	1.5		5.5
8/16	1245	Clarifier #1	8.5	2.5		6.0
		Clarifier #2	8.5	2.0		6.5
		Cl_2 Contact Basin *	7.0	1.0		6.0
9/5	1145	Clarifier #1	8.5	1.5	7.0	0.0
		Clarifier #2	8.5	1.0	5.5	2.0
		Cl_2 Contact Basin *	7.0			
		half way		6.0		1.0
		near outlet		6.0		1.0
9/5	1600	Clarifier #1	8.5		3.0	5.5
		Clarifier #2	8.5		4.0	4.5
		Cl_2 Contact Basin *	7.0			
		half way		5.0		2.0
		near outlet		6.5		0.5
9/6	1340	Clarifier #1	8.5	1.0	5.5	2.0
		Clarifier #2	8.5	1.0	5.5	2.0
		Cl_2 Contact Basin *	7.0	5.5		1.5
9/26	1115	Clarifier #1	8.5	0.0	8.5	0.0
		Clarifier #2	8.5	0.0	8.5	0.0
		Cl_2 Contact Basin *	7.0	3.0	4.0	0.0
9/26	1520	Clarifier #1	8.5	1.0	7.0	0.5
		Clarifier #2	8.5	1.0	7.0	0.5

* Cl_2 contact basin samples collected near outlet unless otherwise specified.

** see Figure 3 for numbering system. On 7/25-26 and 9/5-6 one Cl_2 contact chamber was operating. On 8/15-16 and 9/26-27 both Cl_2 contact chambers were operating.

Table 22. Duvall STP - Comparison of Inspection Results with NPDES Permit Limits - SRD 1989.

Parameter *	NPDES Permit Limits Monthly Average	NPDES Permit Limits Weekly Average	7/25-26 Ecology Samples	8/15-16 Ecology Samples	8/15-16 STP Samples	9/5-6 Ecology Samples	9/26-27 Ecology Samples	9/26-27 + Ecology Samples
BOD_5								
(mg/L)	30	45	14 J	LAC	38 J	NR	22 PJ	85 PJ
(lbs/D)	50	75	17		48		27	104
(% removal)	85				84			
TSS								
(mg/L)	30	45	50	54	47	140	110	92
(lbs/D)	50	75	61	68	60	193	135	113
(% removal)	85			70	69			
Fecal coliform (#/100 mL)	200	100 **	12000 29	27000 JL 8400 JL 9300 JL		24000 JL 75000 JL	2000 1800	1300
pH (S.U.)	shall not be outside the range 6.0 - 9.0		7.2,7.2,7.3	7.4,7.4,7.5		7.5.7.3,7.6	7.3,7.3,7.7	
Flow (MGD)			0.147	0.152	0.152	0.165	0.147	0.147

* Ecology analytical results - composite samples for BOD_5 and TSS; grab samples for pH and fecal coliforms
** usually 400
\+ duplicate analysis
J estimated
JL estimated - total plate count >200
NR requested but not analyzed
PJ estimated - greater than
LAC laboratory accident

Table 23. Duvall STP-Priority Pollutants Detected and Toxicity Criteria Comparison-SRD, 1989.

Sample:	Transfer Blk	Duvall Influent		Duvall Sludge		Statewide Class II Sludge Data ***		
Lab Log #:	338425	338407	338408	338415				
Type:		Grab	Grab	Grab				
Date:	8/15	8/15	8/15	8/16				
Time:	1140	1125	1600	1205				
% Solids				++				
TOC (% dry wt basis)				45				
VOA Compounds	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/Kg dry wt)			
Methylene Chloride	1 J	-	2 J	-	-			
Acetone	-	-	-	14	2000			
Chloroform	-	11	12	-	-			
1,1,1-Trichloroethane	-	-	1 J	-	-			
Toluene	-	-	2 J	3 J	490 J			
Lab Log #:	338425	338402		338415				
Type:		ECO-Comp		Grab				
Date:	8/15	8/15-16		8/16				
	(μg/L)	(μg/L)		(μg/L)	(μg/Kg dry wt)			
Cyanide		4						
BNA Compounds								
Phenol	-	4 J		13	2000			
Benzyl Alcohol	-	17		-	-			
4-Methylphenol	-	23		34	5200			
Benzoic Acid	-	148		-	-			
Di-n-Butyl Phthalate	32 B	26 B		-	-			
Butylbenxylphthalate	-	6 J		5 J	720 J			
Bis(2-Ethylhexyl)phthalate	1 J	32		150	22000			
Total Phthalate Esters								
Lab Log #:	338425	338402		338414		Geometric		#
Type:		ECO-Comp		Grab				
Date:	8/15	8/15-16		8/16		Mean	Range	Sampled
Metals	(μg/L)	(μg/L)		(μg/L)	(mg/Kg dry wt)	(mg/Kg dry wt)		
Arsenic	-	1.9 R		18.9	1.9			
Cadmium	-	-		23	2.3	7.6	<0.1-25	34
Chromium	-	5.0		63	6.4	62	15-300	34
Copper	-	52.1		1320	135	400	75-1700	34
Lead	12.9	10 B		180	18	210	34-600	34
Mercury	-	0.33		17.5	1.8			
Nickel	-	-		89	9.1	26	<0.1-62	29
Selenium	-	-		9.7 J	1.0 J			
Silver	-	-		20.2	2.1			
Zinc	7.0 B	104 B		2550	260	1200	165-3370	33

Table 23. (Continued) - SRD, 1989.

Sample:	Duvall Effluent					Freshwater Tox. Crit. (EPA, 1986b)	
Lab Log #:	338410	338412					
Type:	Grab	Grab					
Date:	8/15	8/15					
Time:	1105	1540				Acute	Chronic
% Solids							
TOC (% dry wt basis)							
VOA Compounds	(µg/L)	(µg/L)				(µg/L)	(µg/L)
Methylene Chloride	-	-					
Acetone	-	-					
Chloroform	2 J	2 J				28900 *	1240 *
1,1,1-Trichloroethane	-	-					
Toluene	-	-					
Lab Log #:	338405						
Type:	ECO-Comp						
Date:	8/15-16						
	(µg/L)						
Cyanide (µg/L)	5					22	5.2
BNA Compounds							
Phenol	-						
Benzyl Alcohol	-						
4-Methylphenol	-						
Benzoic Acid	-						
Di-n-Butyl Phthalate	15 B						
Butylbenxylphthalate	-						
Bis(2-Ethylhexyl)phthalate	8 J						
Total Phthalate Esters	23 **					940 *	3 *
Lab Log #:	338405	308094	368248	398191	398194		
Type:	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp		
Date:	8/15-16	7/25-26	9/5-6	9/26-27	9/26-27		
Metals	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)		
Arsenic	1.7 R	-	-	-	-	850(360) *+	48(190) *+
Cadmium	-	-	-	-	-		
Chromium	-	-	-	-	-		
Copper	23	15	26	28	28	7 +	5 +
Lead	4.3 B	3.6 B	3.9 B	3.9 B	3.6 B	25 +	1.0 +
Mercury	0.22	0.42	0.10	0.25	0.29	2.4	0.012
Nickel	-	-	-	-	-		
Selenium	-	-	-	-	-		
Silver	1.7	-	-	4.5	3.8	0.8 +	0.12
Zinc	52.2 B	66.7 B	82.2	105	114	53 +	48 +

+ calculation based on hardness (39 mg/L).

++ 0.66% solids were found in the organics sample - used for dry weight calculations of organics.
0.98% solids were found in the TOC sample - used for dry weight calculations of metals.

* insufficient data to develop criteria - Lowest Observed Effect Level (LOEL) presented.

** qualifiers have been dropped.

*** summary of data collected during previous Class II Inspections statewide at activated sludge plants (Hallinan, 1988).

*+ Pent(Tri) - Pent is LOEL

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.

J Indicates an estimated value when result is less than specified detection limit.

R low spike recovery - result may be biased low.

Table 24. Duvall STP - Effluent Bioassay Results - SRD, 1989.

Rainbow Trout (*Oncorhynchus mykiss*) - 96 hour survival test

Sample	# Tested	# Survived	Percent Mortality	Percent Survival
Control	20	20	0	100
6.25 % Effluent	20	20	0	100
12.5 % Effluent	20	20	0	100
25.0 % Effluent	20	20	0	100
50.0 % Effluent	20	10	50	50
100 % Effluent	20	0	100	0

96 hr LC_{50} = 50% effluent

Ceriodaphnia dubia - 48 hour survival and 7 day reproduction test

		after 48 hours			after 7 days			
Sample	# Tested	# Survived	Percent Mortality	Percent Survival	# Survived	Percent Mortality	Percent Survival	Mean # Young per Original Female
Control	10	8	20	80	8	20	80	28.5
6.25 % Effluent	10	10	0	100	9	10	90	29.3
12.5 % Effluent	10	10	0	100	10	0	100	25.4
25.0 % Effluent	10	8	20	80	8	20	80	23.2
50.0 % Effluent	10	10	0	100	10	0	100	15.1
100 % Effluent	10	8	20	80	7	30	70	0.42

48 hr LC_{50} > 100% effluent

NOEC = 25% effluent
LOEC = 50% effluent

Table 24. (Continued) - SRD, 1989.

Fathead Minnow (*Pimephales promelas*) - 96 hour survival and 7 day growth test

Sample	# Tested	after 96 hours: # Survived	after 96 hours: Percent Mortality	after 96 hours: Percent Survival	after 7 days: # Survived	after 7 days: Percent Mortality	after 7 days: Percent Survival	after 7 days: Mean Weight per Fish (mg)
Control	30	23	23	77	23	23	77	0.27
6.25 % Effluent	30	23	23	77	20	33	67	0.34
12.5 % Effluent	30	27	10	90	25	17	83	0.38
25.0 % Effluent	30	30	0	100	28	7	93	0.34
50.0 % Effluent	30	23	23	77	20	33	67	0.31
100 % Effluent	30	3	90	10	1	97	3	N/A

96 hr LC_{50} = 62% effluent

NOEC = 50% effluent
LOEC = 100% effluent

NOEC - no observable effects concentration
LOEC - lowest observable effects concentration
LC_{50} - lethal concentration for 50% of the organisms
EC_{50} - effect concentration for 50% of the organisms

Table 25. Duvall STP-Split Sample Results Comparison - SRD, 1989.

Parameter	Laboratory						
		Lab Log- :	338401	338403	338404	338406	368252
		Numbers :	338402		338405		
		Sample:	ECO-Inf	STP-Inf	ECO- Ef	STP-Ef	Effluent
		Date:	8/15-16	8/15-16	8/15-16	8/15-16	9/5
		Time:	1200-1200	1200-1200	1200-1200	1200-1200	1130
		Type:	Composite	Composite	Composite	Composite	Grab
Total Chlorine Residual (mg/L)	Ecology						0.6
	Duvall						0.5
TSS (mg/L)	Ecology		180	150	54	47	
	Duvall		181	154	49	50	
BOD_5 (mg/L)	Ecology		LAC	240J	LAC	38J	
	Duvall		327	321	36	63	
Fecal Coliform (#/100mL)	Ecology						24000JL
	Duvall						1800

J estimated value
L plate count greater than 200
LAC laboratory accident

WEYERHAEUSER LOG POND

SETTING

The Weyerhaeuser log pond is roughly circular with a large island in the center occupying two-thirds or more of the roughly 150 acre pond site. The pond is not being used by Weyco in the production process (Proffitt, 1990). Stormwater runoff from Weyco is discharged through the pond into the Snoqualmie River. The study period was fairly dry so pond discharge was minimal. Discharge that did occur went into a swampy area between the pond and the river. Samples collected, sampling times, and parameters analyzed are summarized in Table 26.

RESULTS AND DISCUSSION

Flow Measurement

The weir installed at the pond discharge structure was too large to measure inspection flows. The discharge was seeping through small leaks in the discharge structure and/or trickling over the weir. Visual estimates of the flow rates are provided in Table 27. Estimates ranged between 2 and 10 gpm.

Chemistry Results/NPDES Permit Compliance

The discharge water quality was good during the inspections (Table 28). BOD_5, TSS, nutrient, fecal coliform, and metals concentrations were low. All NPDES permit parameters were well within limits, in part reflecting low summer flow conditions being compared to stormwater runoff permit limits (Table 29).

Sample Splits

Weyco analyzed sample splits for most of the parameters analyzed by Ecology. Split sample results were comparable (Table 30).

RECOMMENDATIONS AND CONCLUSIONS

Water of good quality was discharged in small quantities from the Weyco log pond. Wet weather sampling would be necessary to fully evaluate permit compliance.

Table 26. Weyerhaeuser Log Pond Sample Collection - SRD, 1989.

	7/25-26				8/15-16				9/5-6				9/26-27			
Lab Log- : Numbers :	308098	308099		308097	338423	338424		338418	368254	368255		368249	398184	398185		398192
Sample:	Effluent	Effluent	Effluent	ECO- Ef	Effluent	Effluent	Effluent	ECO- Ef	Effluent	Effluent	Effluent	ECO- Ef	Effluent	Effluent	Effluent	ECO- Ef
Date:	7/25	7/25	7/26	7/25-26	8/15	8/15	8/16	8/15-16	9/5	9/5	9/6	9/5-6	9/26	9/26	9/27	9/26-27
Time:	1005	1500	1105	*	1005	1420	1000	*	0845	1510	0850	*	0900	1355	0940	*
Type:	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Composite
Field Analyses																
pH	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Temperature	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Conductivity	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Chlorine Residual																
Total					E											
Laboratory Analyses																
Turbidity				E				EW				EW				EW
Conductivity				E				EW				EW				EW
Alkalinity				E				EW				EW				EW
Hardness				E				EW				EW				EW
Chloride				E				EW				EW				EW
Cyanide																
TS				E				EW				EW				EW
TNVS				E				EW				EW				EW
TSS				E				EW				EW				EW
TNVSS				E				EW				EW				EW
BOD_5				E				EW				EW				EW
Inhib. BOD_5																
COD				E				EW				EW				EW
TOC																
NH_3-N				E				EW				EW				EW
NO_3+NO_2-N				E				EW				EW				EW
Total-P				E				EW				EW				EW
Ortho-P				E				EW				EW				EW
% Solids																
Fecal Coliform	E	E			E	E			E	E			E	E		
pp metals				E				EW				EW				EW

* composite was made by mixing equal volumes of the three grab samples.
E Ecology laboratory analysis
W Weyerhaeuser laboratory analysis

Table 27. Weyerhaeuser Log Pond Flow Estimates - SRD, 1989.

Date	Effluent Flow Estimates * (gpm)	(gpd)
7/25-26	10	14400
8/15-16	2	2880
9/5-6	4	5760
9/26-27	2	2880

* Discharge during the inspections occurred as seepage around the discharge weir and the flow rate could only be estimated.

Table 28. Weyerhaeuser Log Pond - Ecology Laboratory Results - SRD, 1989.

	7/25-26				8/15-16				9/5-6				9/26-27			
Lab Log # :	308098	308099		308097	338423	338424		338418	368254	368255		368249	398184	398185		398192
Sample:	Effluent	Effluent	Effluent	ECO- Ef	Effluent	Effluent	Effluent	ECO- Ef	Effluent	Effluent	Effluent	ECO- Ef	Effluent	Effluent	Effluent	ECO- Ef
Date:	7/25	7/25	7/26	7/25-26	8/15	8/15	8/16	8/15-16	9/5	9/5	9/6	9/5-6	9/26	9/26	9/27	9/26-27
Time:	1005	1500	1105	*	1005	1420	1000	*	0845	1510	0850	*	0900	1355	0940	*
Type:	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Composite	Grab	Grab	Grab	Composite
Field Analyses																
pH (S.U.)	7.5	7.7	7.5	7.5	7.0	6.9	7.2	7.1	7.1	7.3	7.3	7.3	7.2	7.1	7.5	7.4
Temperature (C)	22.9	25.0	24.0	12.0	20.4	21.5	19.9	10.3	18.9	21.3	18.4	7.3	17.7	18.5	17.4	8.4
Conductivity (umhos/cm)	161	148	153	143	147	143	145	142	135	143	148	138	138	146	146	147
Chlorine Residual (mg/L)																
Total					<0.1											
Laboratory Analyses																
Turbidity (NTU)				1.5				1.7				1.4				1.5
Conductivity (umhos/cm)				138				145				147				153
Alkalinity (mg/L $CaCO_3$)				59				57				62				61
Hardness (mg/L $CaCO_3$)				54				56				58				58
Chloride (mg/L)				7.1				7.0				7.3				8.3
Cyanide (µg/L)																
TS (mg/L)				100				120				153 J				130
TNVS (mg/L)				62				60				78 J				78
TSS (mg/L)				9				4				3 J				1 U
TNVSS (mg/L)				3				1 U				1 UJ				1 U
BOD_5 (mg/L)				<4 J				<4 J				<4 J				<6 J
Inhib. BOD_5 (mg/L)																
COD (mg/L)				21				22				23				20
TOC (mg/L)																
NH_3-N (mg/L)				0.17				0.02 J				0.04				0.08
NO_3+NO_2-N (mg/L)				<0.02				<0.01 J				0.02				0.01
Total-P (mg/L)				0.06				0.05 J				0.05				0.08
Ortho-P (mg/L)				0.26 J				<0.01 J				0.05				0.01
% Solids																
Fecal Coliform (#/100mL)	11	3			3	8			14	3 U			3	6		
Antimony (µg/L)				2.0 U				3.0 U				3.0 U				3.0 U
Arsenic (µg/L)				1.6				2.9 R				1.8 R				1.9 R
Beryllium (µg/L)				2.0 U				2.0 U				2.0 U				2.0 U
Cadmium (µg/L)				5.0 U				5.0 U				5.0 U				5.0 U
Chromium (µg/L)				5.0 U				5.0 U				5.0 U				5.0 U
Copper (µg/L)				4.0 U				4.0 U				4.0 U				4.0 U
Lead (µg/L)				1.2 B				1.0 U				1.0 U				1.0 U
Mercury (µg/L)				0.06 U				0.06 U				0.02 UH				0.06 U
Nickel (µg/L)				20 U				20 U				20 U				20 U
Selenium (µg/L)				2.0 U				2.0 U				2.0 U				2.0 U
Silver (µg/L)				0.50 U				0.50 U				0.50 U				0.50 U
Thallium (µg/L)				1.0 U				2.0 U				1.0 U				1.0 U
Zinc (µg/L)				23.3 B				8.0 B				1310 **				3.8 B

* - composite was made by mixing equal volumes of the three grab samples.
** - high value likely due to sampling or sample container contamination.
J - indicates estimated value.
U - indicates compound was analyzed for but not detected at the given detection limit.
B - This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.
UJ - indicates compound was analyzed for but not detected at the given detection limit, and the internal standard on which detection limit quantification was based was outside acceptance limits.
R - low spike recovery - result may be biased low.
H - compound analyzied after acceptable holding time had passed.
UH - comments U + H

Table 29. Weyerhaueser Log Pond - Comparison of Inspection Results with NPDES Permit Limits - SRD, 1989.

Parameter *	NPDES Permit Limits Daily Maximum	7/24-25 Ecology Samples	8/15-16 Ecology Samples	9/5-6 Ecology Samples	9/26-27 Ecology Samples
BOD_5					
(mg/L)	20	4 JU	4 JU	4 JU	6 JU
(lbs/D)	228	1 U	1 U	1 U	1 U
TSS					
(mg/L)	110	9	4	3 J	1 U
(lbs/D)	1585	1	1 U	1 U	1 U
pH (S.U.)	shall not be outside the range 6.0 - 9.0	7.5,7.7,7.5	7.0,6.9,7.2	7.1,7.3,7.3	7.2,7.1, 7.5
Flow (MGD)	1.728	0.0144	0.0029	0.0058	0.0029

* Ecology analytical results - composite samples for BOD_5 and TSS
grab samples for pH
J estimated
U less than
JU comments J + U

Table 30. Weyerhaeuser Log Pond - Split Sample Results Comparison - SRD, 1989.

Lab Log #:	338418		368249		398192	
Sample:	ECO- Ef	ECO- Ef	ECO- Ef	ECO- Ef	ECO- Ef	ECO- Ef
Date:	8/15-16	8/15-16	9/5-6	9/5-6	9/26-27	9/26-27
Time:	*	*	*	*	*	*
Type:	Composite	Composite	Composite	Composite	Composite	Composite
Lab:	Ecology	Weyco	Ecology	Weyco	Ecology	Weyco
Laboratory Analyses						
Turbidity (NTU)	1.7	2.3	1.4	1.4	1.5	2.4
Conductivity (umhos/cm)	145	160	147	160	153	160
Alkalinity (mg/L $CaCO_3$)	57	58	62	60	61	60
Hardness (mg/L $CaCO_3$)	56	52.4	58	54.0	58	53.3
Chloride (mg/L)	7.0	7.2	7.3	7.2	8.3	8.2
TS (mg/L)	120	120	153 J	98	130	120
TNVS (mg/L)	60	79	78 J	80	78	60
TSS (mg/L)	4	4	3 J	18	1 U	5
TNVSS (mg/L)	1 U	2	1 UJ	2	1 U	<1
BOD_5 (mg/L)	<4 J	<3	<4 J	<3	<6 J	<3
COD (mg/L)	22	12	23	19	20	22
NH_3-N (mg/L)	0.02 J	<0.02	0.04	0.03	0.08	<0.02
NO_3+NO_2-N (mg/L)	<0.01 J	<0.05	0.02	<0.05	0.01	<0.05
Total-P (mg/L)	0.05 J	0.04	0.05	0.04	0.08	0.05
Ortho-P (mg/L)	<0.01 J	0.05	0.05	0.02	0.01	<0.01
Antimony (μg/L)	3.0 U	<50	3.0 U	<50	3.0 U	<50
Arsenic (μg/L)	2.9 R	3	1.8 R	2	1.9 R	4
Beryllium (μg/L)	2.0 U	<10	2.0 U	<10	2.0 U	<10
Cadmium (μg/L)	5.0 U	<10	5.0 U	<10	5.0 U	<10
Chromium (μg/L)	5.0 U	<10	5.0 U	<10	5.0 U	<10
Copper (μg/L)	4.0 U	<10	4.0 U	28 +	4.0 U	<10
Lead (μg/L)	1.0 U	<2	1.0 U	4	1.0 U	<2
Mercury (μg/L)	0.06 U	<0.2	0.02 UH	<1	0.06 U	<0.2
Nickel (μg/L)	20 U	<30	20 U	<30	20 U	<30
Selenium (μg/L)	2.0 U	<2	2.0 U	<2	2.0 U	<2
Silver (μg/L)	0.50 U	<10	0.50 U	<10	0.50 U	<10
Thallium (μg/L)	2.0 U	<2	1.0 U	<2	1.0 U	<2
Zinc (μg/L)	8.0 B	<10	1310 **	11 +	3.8 B	<10

* composite was made by mixing equal volumes of the three grab samples.
** high value likely due to sampling or sample container contamination.
\+ result of duplicate analysis was <10

UJ indicates compound was analyzed for but not detected at the given detection limit, and the internal standard on which detection limit quantification was based was outside acceptance limits.
U indicates compound was analyzed for but not detected at the given detection limit.
J indicates an estimated value.
R low spike recovery - result may be biased low
B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination
H compound analyzied after acceptable holding time had passed.
UH comments U + H

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APPENDIX A

Appendix A. Results of VOA, BNA, Pest/PCB and Metal Priority Pollutant Scans of Water Samples - SRD 1989.

Sample:	Transfer Blank	North Bend Influent		North Bend Effluent		Transfer Blank	Duvall Influent		Duvall Effluent		Transfer Blank	Snoqualmie Influent		Snoqualmie Effluent	
Lab Log #:	308080	308085	308086	308087	308088	338425	338407	338408	338410	338412	368231	368238	368239	368241	368243
Type:		Grab	Grab	Grab	Grab		Grab	Grab	Grab	Grab		Grab	Grab	Grab	Grab
Date:	7/25	7/25	7/25	7/25	7/25	8/15	8/15	8/15	8/15	8/15	9/5	9/5	9/5	9/5	9/5
Time:	0835	0945	1420	0930	1430	1140	1125	1600	1105	1540	0910	0920	1350	1005	1415
VOA Compounds (µg/L)															
Chloromethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	50 U
Bromomethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	50 U
Vinyl Chloride	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	50 U
Chloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	50 U
Methylene Chloride	5 U	5 U	5 U	5 U	5 U	1 J	5 U	2 J	5 U	5 U	5 U	5 U	5 U	80	55
Acetone	10 U	100	200	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	22 J	17	590 DJ	860 J
Carbon Disulfide	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
1,1-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
1,1-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
1,2-Dichloroethene (total)	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Chloroform	5 U	2 J	2 J	5 U	2 J	5 U	11	12	2 J	2 J	5 U	6	3 J	8	9 J
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	50 U
1,2-Dichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
1,1,1-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 J	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Carbon Tetrachloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Vinyl Acetate	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	50 U
Bromodichloromethane	5 U	5 U	5 U	1 J	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
1,2-Dichloropropane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Benzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Dibromochloromethane	5 U	5 U	5 U	5 U	6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
1,1,2-Trichloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Bromoform	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
4-Methyl-2-Pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	50 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	50 U
1,1,2,2-Tetrachloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Tetrachloroethene	5 U	5	7	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Toluene	5 U	2 J	2 J	2 J	5 U	5 U	5 U	2 J	5 U	5 U	5 U	2 J	4 J	2 J	25 U
Chlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
trans-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Ethylbenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
cis-1,3-Dichloropropene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Styrene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	25 U
Total Xylenes	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2 J	5 U	25 U
2-Chloroethylvinylether															

Appendix A. (Continued) - SRD, 1989.

Sample:	T Blank	NB Influent	NB Effluent	T Blank	Duv Influent	Duv Effluent	T Blank	Snoq Influent	Snoq Effluent
Lab Log #:	308080	308081	308083	338425	338402	338405	368231	368233	368235
Type:		ECO-Comp	ECO-Comp		ECO-Comp	ECO-Comp		ECO-Comp	ECO-Comp
Date:	7/25	7/25-26	7/25-26	8/15	8/15-16	8/15-16	9/5	9/5-6	9/5-6
BNA Compounds (µg/L)									
Phenol	10 U	6 J	10 U	10 U	4 J	10 U	10 U	3 J	10 U
Aniline									
Bis(2-Chloroethyl)Ether	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,4-Dichlorobenzene	10 U	2 J	10 U	10 U	10 U	10 U	10 U	3 J	10 U
Benzyl Alcohol	10 U	9 J	10 U	10 U	17	10 U	10 U	22	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-chloroisopropyl)ether	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methylphenol	10 U	44	10 U	10 U	23	10 U	10 U	17	10 U
N-Nitroso-Di-n-Propylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzoic Acid	50 U	15 J	50 U	50 U	148	50 U	50 U	62	50 U
Bis(2-Chloroethoxy)Methane	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	10 U	10 U	2 UJ	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Dimethyl Phthalate	10 U	10 U	10 U	10 U	10 U	10 U	10 U	1 J	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
3-Nitroaniline	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Acenaphthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Appendix A. (Continued) - SRD, 1989.

Sample:	T Blank	NB Influent	NB Effluent	T Blank	Duv Influent	Duv Effluent	T Blank	Snoq Influent	Snoq Effluent
Lab Log #:	308080	308081	308083	338425	338402	338405	368231	368233	368235
Type:		ECO-Comp	ECO-Comp		ECO-Comp	ECO-Comp		ECO-Comp	ECO-Comp
Date:	7/25	7/25-26	7/25-26	8/15	8/15-16	8/15-16	9/5	9/5-6	9/5-6
BNA Compounds (μg/L)									
2,4-Dinitrophenol	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4-Nitrophenol	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Diethyl Phthalate	10 U	6 J	10 U	10 U	10 U	10 U	10 U	6 J	10 U
4-Chlorophenyl-Phenylether	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
4,6-Dinitro-2-Methylphenol	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
N-Nitrosodiphenylamine	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2-Diphenylhydrazine									
4-Bromophenyl-Phenylether	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Phenanthrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Di-n-Butyl Phthalate	10 U	2 J	10 U	32 B	26 B	15 B	52 UJ	18 UJ	45 UJ
Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzidine									
Butylbenxylphthalate	10 U	4 J	10 U	10 U	6 J	10 U	7 UJ	12 UJ	12 UJ
3,3'-Dichlorobenzidine	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Benzo(a)Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-Ethylhexyl)phthalate	10 U	25	10 U	1 J	32	8 J	10 U	27	3 J
Di-n-Octyl Phthalate	10 U	1 J	10 U	10 U	3 UJ	10 U	10 U	2 J	10 U
Benzo(b)Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(k)Fluoranthene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(a)Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Indeno(1,2,3-cd)Pyrene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Dibenzo(a,h)Anthracene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(g,h,i)Perylene	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Appendix A. (Continued) - SRD, 1989.

Sample: Lab Log #: Type: Date:	T Blank 308080 7/25	NB Influent 308081 ECO-Comp 7/25-26	NB Effluent 308083 ECO-Comp 7/25-26	T Blank 338425 8/15	Duv Influent 338402 ECO-Comp 8/15-16	Duv Effluent 338405 ECO-Comp 8/15-16	T Blank 368231 9/5	Snoq Influent 368233 ECO-Comp 9/5-6	Snoq Effluent 368235 ECO-Comp 9/5-6
Pest/PCB Compounds (µg/L)									
alpha-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
gamma-BHC (Lindane)	0.05 U	0.01 J	0.27	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Aldrin	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Heptachlor Epoxide	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Endosulfan I	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Dieldrin	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan II	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDD	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan Sulfate	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.065 J	0.10 U
Methoxychlor	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Endrin Ketone	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
alpha-Chlordane	0.50 U	0.50 U	0.092 J	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
gamma-Chlordane	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Toxaphene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Aroclor-1016	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1221	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1232	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1242	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1248	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1254	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Aroclor-1260	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Endrin Aldehyde									

Appendix A. (Continued) - SRD, 1989.

Sample:	T Blank	NB Influent	NB Effluent	T Blank	Duv Influent	Duv Effluent	T Blank	Snoq Influent	Snoq Effluent
Lab Log #:	308080	308081	308083	338425	338402	338405	368231	368233	368235
Type:		ECO-Comp	ECO-Comp		ECO-Comp	ECO-Comp		ECO-Comp	ECO-Comp
Date:	7/25	7/25-26	7/25-26	8/15	8/15-16	8/15-16	9/5	9/5-6	9/5-6
Priority pollutant metals (µg/L)									
Antimony	2.0 U	2.0 U	2.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
Arsenic	1.0 U	3.8	4.2	1.0 UR	1.9 R	1.7 R	1.0 UR	1.0 UR	1.0 UR
Beryllium	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Cadmium	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Chromium	5.0 U	5.0 U	5.0 U	5.0 U	5.0	5.0 U	5.0 U	12	5.0 U
Copper	4.0 U	40.2	4.0 U	4.0 U	52.1	23	4.0 U	136	20
Lead	1.0 U	5.4 B	5.7 B	12.9	10 B	4.3 B	1.0 U	10.1 B	2.9 B
Mercury	0.06 U	0.17	0.06 U	0.06 U	0.33	0.22	0.06 U	0.08	0.06 U
Nickel	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
Selenium	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
Silver	0.50 U	1.0	0.50 U	0.50 U	0.50 U	1.7	0.50 U	0.50 U	0.50 U
Thallium	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U	2.0 U	1.0 U	1.0 U	1.0 U
Zinc	40.6 B	120 B	95.1 B	7.0 B	104 B	52.2 B	4.9 B	134 B	30.4 B

U indicates compound was analyzed for but not detected at the given detection limit.

J indicates an estimated value when result is less than specified detection limit.

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.

D value from analysis of a diluted sample.

UJ indicates compound was analyzed for but not detected at the given detection limit, and the internal standard on which detection limit quantification was based was outside acceptance limits.

DJ comment D plus comment J.

R low spike recovery - result may be biased low.

UR indicates compound was analyzed for but not detected at the given detection limit, and the spike recovery was low so the actual detection limit may be higher.

APPENDIX B

Appendix B. Tentatively Identified Compounds (TICs) in the VOA and BNA Scans of Water Samples - SRD, 1989.

Sample:		North Bend Influent		North Bend Effluent		Duvall Influent		Duvall Effluent		Snoqualmie Influent		Snoqualmie Effluent	
Lab Log #:		308085	308086	308087	308088	338407	338408	338410	338412	368238	368239	368241	368243
Type:		Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab	Grab
Date:		7/25	7/25	7/25	7/25	8/15	8/15	8/15	8/15	9/5	9/5	9/5	9/5
Time:		0945	1420	0930	1430	1125	1600	1105	1540	0920	1350	1005	1415
Compound	Retention Time												
VOA Scan (µg/L)													
Ethanol	7.08										24 J		
Ethanol	7.10		30 J										
Ethanol	7.12	37 J											
Unknown	7.22						5 J						
Cineole	29.81		6 J										
Unknown Hydrocarbon C10H16	30.86											13 J	
Unknown Hydrocarbon C10H16	30.89										14 J		
Unknown	31.39			5 J									
Unknown	32.22						6 J						
Cyclohexene, 1-methyl-4-(1-methylethylidene)	32.47			22 J									
Unknown	32.82		6 J										

Sample:		NB Influent	NB Effluent	Duv Influent	Duv Effluent	Snoq Influent	Snoq Effluent
Lab Log #:		308081	308083	338402	338405	368233	368235
Type:		ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp
Date:		7/25-26	7/25-26	8/15-16	8/15-16	9/5-6	9/5-6
Compound	Retention Time						
BNA Scan (µg/L)							
Ethanol, 2-butoxy-	10.30	72 J					
Unknown	15.70	17 J					
Unknown	15.89	23 J					
Decanoic Acid	18.34	58 J					
Cyclopropane, nonyl-	20.04	67 J					
Dodecanamide,N,N-bis(2-hydroxyethyl)	21.09	99 J					
Unknown Alkane	21.45	36 J					

Appendix B. (Continued) - SRD, 1989.

Sample:		NB Influent	NB Effluent	Duv Influent	Duv Effluent	Snoq Influent	Snoq Effluent
Lab Log #:		308081	308083	338402	338405	368233	368235
Type:		ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp
Date:		7/25-26	7/25-26	8/15-16	8/15-16	9/5-6	9/5-6
Compound	Retention Time						
BNA Scan (µg/L)							
Cyclotetradecane	22.74	37 J					
Tetradecanoic Acid	23.55	33 J					
1-Tetradecanol	23.99	19 J					
Caffeine	24.94	36 J					
Unknown Alkane	25.14	38 J					
Unknown	25.66	13 J					
Hexadecanoic Acid	25.86	60 J					
Hexadecane	27.29	19 J					
Unknown	35.32	100 J					
Unknown	42.21	33 J					
Unknown	43.48	70 J					
Unknown	45.43	20 J					
Unknown	49.33	21 J					
Unknown	10.69		8 BJ				
Ethanol, 1-(2-butoxyethoxy)	15.69		22 J				
Unknown	18.34		5 J				
Ethanol, 2-butoxy-	9.72			67 J			
Unknown - Trimethyl Octane Isomer	10.94			21 J			
Octanoic Acid	14.82			21 J			
Butoxyethoxy Ethanol Isomer	15.10			46 J			
Unknown	15.27			25 J			
Unknown	17.75			25 J			
Unknown Alkane	19.34			21 J			
Unknown	20.49			78 J			
Unknown	21.97			56 J			
Tetradecanoic Acid	22.94			75 J			
Unknown	23.19			35 J			
Caffeine	24.27			23 J			
Unknown	24.32			76 J			
Hexadecanoic Acid	25.17			33 J			
Unknown	26.49			31 J			
Unknown Hexanedioic Acid Ester	29.42			250 BJ			
Unknown	33.99			280 J			

Appendix B. (Continued) - SRD, 1989.

Sample:		NB Influent	NB Effluent	Duv Influent	Duv Effluent	Snoq Influent	Snoq Effluent
Lab Log #:		308081	308083	338402	338405	368233	368235
Type:		ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp	ECO-Comp
Date:		7/25-26	7/25-26	8/15-16	8/15-16	9/5-6	9/5-6
Compound	Retention Time						
BNA Scan ($\mu g/L$)							
Unknown	39.67			200 J			
Cholesterol	40.66			210 J			
Unknown	45.83			100 J			
Unknown	10.09				6 BJ		
Unknown	11.65				6 J		
Unknown	11.72				5 J		
Unknown	19.40				7 BJ		
Unknown Phthalate	24.29				15 BJ		
Unknown	33.04				17 J		
Unknown	33.97				120 J		
Unknown	39.67				70 J		
Unknown	40.64				71 J		
Ethanol, 2-butoxy-	10.22					150 J	
Unknown	15.77					41 J	
Decanoic Acid	18.24					28 J	
Unknown Cycloalkane	19.84					48 J	
Unknown	20.25					28 J	
Dodecanamide,N,N-bis(2-hydroxyethyl)	20.99					65 J	
Unknown	22.82					69 J	
Tetradecanoic Acid	23.47					64 J	
Caffeine	24.84					80 J	
Pentadecanoic Acid	25.77					180 J	
Unknown	27.77					320 J	
Unknown	27.94					48 J	
Unknown	34.94					100 J	
Unknown	35.34					48 J	
Unknown	35.79					30 J	
Unknown	37.29					32 J	
Unknown	41.49					250 J	
Unknown	42.59					190 J	
Unknown	44.48					28 J	
Unknown	48.19					68 J	
Unknown	22.20						4 J

Appendix B. (Continued) - SRD, 1989.

Sample: Lab Log #: Type: Date:		NB Influent 308081 ECO-Comp 7/25-26	NB Effluent 308083 ECO-Comp 7/25-26	Duv Influent 338402 ECO-Comp 8/15-16	Duv Effluent 338405 ECO-Comp 8/15-16	Snoq Influent 368233 ECO-Comp 9/5-6	Snoq Effluent 368235 ECO-Comp 9/5-6
Compound	Retention Time						
BNA Scan (µg/L)							
Unknown	22.82						6 J
Unknown	24.34						13 J
Unknown	24.84						5 J
Unknown	26.62						4 J
Phytol	27.34						12 J
Phosphoric acid, 2-ethylhexy	30.42						6 BJ
Unknown	30.86						8 J
Unknown Phthalate	31.49						22 BJ
Unknown	34.89						6 J
Unknown	35.52						6 J
Unknown	36.54						18 J

J - indicates an estimated value

B - This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination

BJ - B+J

APPENDIX C

Appendix C. Results of VOA, BNA, Pest/PCB and Metal Priority Pollutant Scans of Sludge Samples - SRD, 1989.

Sample:	Duvall Sludge		North Bend Sludge		Snoqualmie Sludge
Lab Log #:	338415		338427		368246
Date:	8/16		8/16		9/6
Time:	1205		0845		1545-1700
% Solids	*		**		6.5
TOC (% dry wt basis)	45		32		14
VOA Compounds	(µg/L)	(µg/Kg dry wt)	(µg/L)	(µg/Kg dry wt)	(µg/Kg dry wt)
Chloromethane	10 U	1400 U	10 U	2500 U	130 U
Bromomethane	10 U	1400 U	10 U	2500 U	130 U
Vinyl Chloride	10 U	1400 U	10 U	2500 U	130 U
Chloroethane	10 U	1400 U	10 U	2500 U	130 U
Methylene Chloride	5 U	710 U	5 U	1300 U	63 U
Acetone	14	2000	10 U	2500 U	150 UJ
Carbon Disulfide	5 U	710 U	5 U	1300 U	17 J
1,1-Dichloroethene	5 U	710 U	5 U	1300 U	63 U
1,1-Dichloroethane	5 U	710 U	5 U	1300 U	63 U
1,2-Dichloroethene (total)	5 U	710 U	5 U	1300 U	63 U
Chloroform	5 U	710 U	5 U	1300 U	63 U
2-Butanone	10 U	1400 U	10 U	2500 U	40 UJ
1,2-Dichloroethane	5 U	710 U	5 U	1300 U	63 U
1,1,1-Trichloroethane	5 U	710 U	5 U	1300 U	63 U
Carbon Tetrachloride	5 U	710 U	5 U	1300 U	63 U
Vinyl Acetate	10 U	1400 U	10 U	2500 U	130 U
Bromodichloromethane	5 U	710 U	5 U	1300 U	63 U
1,2-Dichloropropane	5 U	710 U	5 U	1300 U	63 U
Trichloroethene	5 U	710 U	5 U	1300 U	63 U
Benzene	5 U	710 U	5 U	1300 U	63 U
Dibromochloromethane	5 U	710 U	5 U	1300 U	63 U
1,1,2-Trichloroethane	5 U	710 U	5 U	1300 U	63 U
Bromoform	5 U	710 U	5 U	1300 U	63 U
4-Methyl-2-Pentanone	10 U	1400 U	10 U	2500 U	130 U
2-Hexanone	10 U	1400 U	10 U	2500 U	130 U
1,1,2,2-Tetrachloroethane	5 U	710 U	5 U	1300 U	63 U
Tetrachloroethene	5 U	710 U	5 U	1300 U	63 U
Toluene	3 J	490 J	5 U	1300 U	63 U
Chlorobenzene	5 U	710 U	5 U	1300 U	100
trans-1,3-Dichloropropene	5 U	710 U	5 U	1300 U	63 U
Ethylbenzene	5 U	710 U	5 U	1300 U	63 U
cis-1,3-Dichloropropene	5 U	710 U	5 U	1300 U	63 U
Styrene	5 U	710 U	5 U	1300 U	21 J
Total Xylenes	5 U	710 U	5 U	1300 U	19 J
2-Chloroethylvinylether					

Appendix C. (Continued) - SRD, 1989.

Sample:	Duvall Sludge		North Bend Sludge		Snoqualmie Sludge
Lab Log #:	338415		338427		368246
Date:	8/16		8/16		9/6
Time:	1205		0845		1545-1700
BNA Compounds	(µg/L)	(µg/Kg dry wt)	(µg/L)	(µg/Kg dry wt)	(µg/Kg dry wt)
Phenol	13	2000	3 J	660 J	8300 U
Aniline					
Bis(2-Chloroethyl)Ether	10 U	1500 U	10 U	2600 U	8300 U
2-Chlorophenol	10 U	1500 U	10 U	2600 U	8300 U
1,3-Dichlorobenzene	10 U	1500 U	10 U	2600 U	8300 U
1,4-Dichlorobenzene	10 U	1500 U	10 U	2600 U	8300 U
Benzyl Alcohol	10 U	1500 U	10 U	2600 U	8300 U
1,2-Dichlorobenzene	10 U	1500 U	10 U	2600 U	8300 U
2-Methylphenol	10 U	1500 U	10 U	2600 U	8300 U
Bis(2-chloroisopropyl)ether	10 U	1500 U	10 U	2600 U	8300 U
4-Methylphenol	34	5200	10 U	2600 U	8300 U
N-Nitroso-Di-n-Propylamine	10 U	1500 U	10 U	2600 U	8300 U
Hexachloroethane	10 U	1500 U	10 U	2600 U	8300 U
Nitrobenzene	10 U	1500 U	10 U	2600 U	8300 U
Isophorone	10 U	1500 U	10 U	2600 U	8300 U
2-Nitrophenol	10 U	1500 U	10 U	2600 U	8300 U
2,4-Dimethylphenol	10 U	1500 U	10 U	2600 U	8300 U
Benzoic Acid	50 U	7600 U	50 U	13000 U	5300 J
Bis(2-Chloroethoxy)Methane	10 U	1500 U	10 U	2600 U	8300 U
2,4-Dichlorophenol	10 U	1500 U	10 U	2600 U	8300 U
1,2,4-Trichlorobenzene	10 U	1500 U	10 U	2600 U	8300 U
Naphthalene	10 U	1500 U	10 U	2600 U	8300 U
4-Chloroaniline	10 U	1500 U	10 U	2600 U	8300 U
Hexachlorobutadiene	10 U	1500 U	10 U	2600 U	8300 U
4-Chloro-3-Methylphenol	10 U	1500 U	10 U	2600 U	8300 U
2-Methylnaphthalene	10 U	1500 U	10 U	2600 U	8300 U
Hexachlorocyclopentadiene	10 U	1500 U	10 U	2600 U	8300 U
2,4,6-Trichlorophenol	10 U	1500 U	10 U	2600 U	8300 U
2,4,5-Trichlorophenol	50 U	7600 U	50 U	13000 U	40000 U
2-Chloronaphthalene	10 U	1500 U	10 U	2600 U	8300 U
2-Nitroaniline	50 U	7600 U	50 U	13000 U	40000 U
Dimethyl Phthalate	10 U	1500 U	10 U	2600 U	8300 U
Acenaphthylene	10 U	1500 U	10 U	2600 U	8300 U
3-Nitroaniline	50 U	7600 U	50 U	13000 U	40000 U
Acenaphthene	10 U	1500 U	11	2900	8300 U
2,4-Dinitrophenol	50 U	7600 U	50 U	13000 U	40000 U
4-Nitrophenol	50 U	7600 U	50 U	13000 U	40000 U

Appendix C. (Continued) - SRD, 1989.

Sample:	Duvall Sludge		North Bend Sludge		Snoqualmie Sludge
Lab Log #:	338415		338427		368246
Date:	8/16		8/16		9/6
Time:	1205		0845		1545-1700
BNA Compounds	(μg/L)	(μg/Kg dry wt)	(μg/L)	(μg/Kg dry wt)	(μg/Kg dry wt)
Dibenzofuran	10 U	1500 U	2 J	390 J	8300 U
2,4-Dinitrotoluene	10 U	1500 U	10 U	2600 U	8300 U
2,6-Dinitrotoluene	10 U	1500 U	10 U	2600 U	8300 U
Diethyl Phthalate	10 U	1500 U	10 U	2600 U	1600 J
4-Chlorophenyl-Phenylether	10 U	1500 U	10 U	2600 U	8300 U
Fluorene	10 U	1500 U	5 J	1200 J	8300 U
4-Nitroaniline	50 U	7600 U	50 U	13000 U	40000 U
4,6-Dinitro-2-Methylphenol	50 U	7600 U	50 U	13000 U	40000 U
N-Nitrosodiphenylamine	10 U	1500 U	96	25000	8300 U
1,2-Diphenylhydrazine					
4-Bromophenyl-Phenylether	10 U	1500 U	10 U	2600 U	8300 U
Hexachlorobenzene	10 U	1500 U	10 U	2600 U	8300 U
Pentachlorophenol	50 U	7600 U	3 J	880 J	40000 U
Phenanthrene	10 U	1500 U	10	2600	940 J
Anthracene	10 U	1500 U	4 J	910 J	8300 U
Di-n-Butyl Phthalate	19 UJ	2900 UJ	83 B	21000 B	1500 UJ
Fluoranthene	10 U	1500 U	10	2400	8300 U
Pyrene	10 U	1500 U	11	2800	900 J
Benzidine					
Butylbenxylphthalate	5 J	720 J	2 J	580 J	8300 U
3,3'-Dichlorobenzidine	20 U	3000 U	20 U	5100 U	17000 U
Benzo(a)Anthracene	10 U	1500 U	3 J	890 J	8300 U
Chrysene	10 U	1500 U	4 J	1000 J	8300 U
Bis(2-Ethylhexyl)phthalate	150	22000	91	23000	41000
Di-n-Octyl Phthalate	8 UJ	1300 UJ	10 U	2600 U	8300 U
Benzo(b)Fluoranthene	10 U	1500 U	2 J	640 J	8300 U
Benzo(k)Fluoranthene	10 U	1500 U	2 J	500 J	8300 U
Benzo(a)Pyrene	10 U	1500 U	2 J	510 J	8300 U
Indeno(1,2,3-cd)Pyrene	10 U	1500 U	10 U	2600 U	8300 U
Dibenzo(a,h)Anthracene	10 U	1500 U	10 U	2600 U	8300 U
Benzo(g,h,i)Perylene	10 U	1500 U	10 U	2600 U	8300 U

Appendix C. (Continued) - SRD, 1989.

Sample: Lab Log #: Date: Time:	Duvall Sludge 338415 8/16 1205		North Bend Sludge 338427 8/16 0845		Snoqualmie Sludge 368246 9/6 1545-1700
Pest/PCB Compounds	(μg/L)	(μg/Kg dry wt)	(μg/L)	(μg/Kg dry wt)	(μg/Kg dry wt)
alpha-BHC	0.5 U	76 U	0.05 U	13 U	200 U
beta-BHC	0.5 U	76 U	0.05 U	13 U	200 U
delta-BHC	0.5 U	76 U	0.05 U	13 U	200 U
gamma-BHC (Lindane)	0.5 U	76 U	1.4 D	360 D	200 U
Heptachlor	0.5 U	76 U	0.05 U	13 U	200 U
Aldrin	0.5 U	76 U	0.05 U	13 U	200 U
Heptachlor Epoxide	0.5 U	76 U	0.05 U	13 U	200 U
Endosulfan I	0.5 U	76 U	0.05 U	13 U	200 U
Dieldrin	1.0 U	150 U	0.10 U	26 U	400 U
4,4'-DDE	1.0 U	150 U	0.10 U	26 U	400 U
Endrin	1.0 U	150 U	0.10 U	26 U	400 U
Endosulfan II	1.0 U	150 U	0.10 U	26 U	400 U
4,4'-DDD	1.0 U	150 U	0.10 U	26 U	400 U
Endosulfan Sulfate	1.0 U	150 U	0.10 U	26 U	210 J
4,4'-DDT	1.0 U	150 U	0.10 U	26 U	400 U
Methoxychlor	5.0 U	760 U	0.50 U	130 U	2000 U
Endrin Ketone	1.0 U	150 U	0.10 U	26 U	400 U
alpha-Chlordane	5.0 U	760 U	0.50 U	130 U	2000 U
gamma-Chlordane	5.0 U	760 U	0.50 U	130 U	2000 U
Toxaphene	10 U	1500 U	1.0 U	260 U	4000 U
Aroclor-1016	5.0 U	760 U	0.50 U	130 U	2000 U
Aroclor-1221	5.0 U	760 U	0.50 U	130 U	2000 U
Aroclor-1232	5.0 U	760 U	0.50 U	130 U	2000 U
Aroclor-1242	5.0 U	760 U	0.50 U	130 U	2000 U
Aroclor-1248	5.0 U	760 U	0.50 U	130 U	2000 U
Aroclor-1254	10 U	1500 U	1.0 U	260 U	4000 U
Aroclor-1260	10 U	1500 U	1.0 U	260 U	4000 U
Endrin Aldehyde					

Appendix C. (Continued) - SRD, 1989.

Sample:	Duvall Sludge		North Bend Sludge		Snoqualmie Sludge
Lab Log #:	338414		338426		368245
Date:	8/16		8/16		9/6
Time:	1205		0845		1545-1700
Priority pollutant metals	(µg/L)	(mg/Kg dry wt)	(µg/L)	(mg/Kg dry wt)	(mg/Kg dry wt)
Antimony	12 U	1.2 U	6.0 U	1.8 U	0.06 UJ
Arsenic	18.9	1.9	24.8	7.3	40
Beryllium	1.0 U	0.1 U	0.50 U	0.1 U	0.17 J
Cadmium	23	2.3	16	4.7	4.8 J
Chromium	63	6.4	34	10	42.0
Copper	1320	135	1270	374	637
Lead	180	18	150	44	120
Mercury	17.5	1.8	8.7	2.6	98
Nickel	89	9.1	62	18	21 J
Selenium	9.7 J	1.0 J	6.0 J	1.8 J	0.024 J
Silver	20.2	2.1	21.3	6.3	54.3
Thallium	4.0 U	0.4 U	2.0 U	0.6 U	0.020 U
Zinc	2550	260	1900	559	1150

* 0.66% solids were found in the organics sample - used for dry weight calculations of organics.
0.98% solids were found in the TOC sample - used for dry weight calculations of metals.

** 0.39% solids were found in the organics sample - used for dry weight calculations of organics.
0.34% solids were found in the TOC sample - used for dry weight calculations of metals.

U indicates compound was analyzed for but not detected at the given detection limit
J indicates an estimated value when result is less than specified detection limit
B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination
D value from analysis of a diluted sample
UJ indicates compound was analyzed for but not detected at the given detection limit, and the internal standard on which detection limit quantification was based was outside acceptance limits

APPENDIX D

Appendix D. Tentatively Identified Compounds (TICs) VOA and BNA Scans of Sludge Samples - SRD, 1989.

Sample: / Lab Log #: / Date: / Time:		Duvall Sludge 338415 8/16 1205		North Bend Sludge 338427 8/16 0845		Snoqualmie Sludge 368246 9/6 1545-1700
Compound	Retention Time					
VOA Scan		(μg/L)	(μg/Kg dry wt)	(μg/L)	(μg/Kg dry wt)	(μg/Kg dry wt)
Methanethiol	2.63	500 J	71000 J			
Methane, thiobis-	8.59	9 J	1300 J			
Disulfide, dimethyl	18.17	50 J	7100 J			
Methanethiol	2.67			5 J	1300 J	
Methane, thiobis-	8.59			12 J	3000 J	
Disulfide, dimethyl	18.17			12 J	3000 J	
BNA Scan		(μg/L)	(μg/Kg dry wt)	(μg/L)	(μg/Kg dry wt)	(μg/Kg dry wt)
Unknown	11.20					32000 BJ
Unknown Alkane	13.54					15000 J
Unknown Alkane	15.49					13000 J
Unknown Alkane	18.27					11000 J
Unknown Alkane	23.00					14000 J
Unknown	23.39					13000 J
Unknown	23.87					9200 J
Unknown Alkane	24.32					7500 J
Unknown Alkane	31.17					12000 J
Unknown	33.42					47000 J
Unknown	35.67					42000 J
Unknown Alkane	36.66					18000 J
Unknown	37.21					34000 J
Unknown	38.22					35000 J
Unknown	42.93					330000 J
Unknown	43.34					150000 J
Unknown	44.03					280000 J
Unknown	45.56					92000 J
Unknown	48.48					23000 J
Unknown	51.34					66000 J

Appendix D. (Continued) - SRD, 1989.

Sample: / Lab Log #: / Date: / Time:		Duvall Sludge 338415 8/16 1205		North Bend Sludge 338427 8/16 0845		Snoqualmie Sludge 368246 9/6 1545-1700
Compound	Retention Time	(μg/L)	(μg/Kg dry wt)	(μg/L)	(μg/Kg dry wt)	(μg/Kg dry wt)
BNA Scan						
Unknown C10H16	12.34			11 J	2800 J	
Unknown C7H5NS	15.92			17 J	4400 J	
Unknown	19.42			42 BJ	11000 BJ	
Heptadecane	22.24			19 J	4900 J	
Benzene, (1-methyldecyl)-	22.44			17 J	4400 J	
Unknown	22.94			72 J	18000 J	
Unknown	23.64			12 J	3100 J	
Unknown Phthalate	24.32			72 BJ	18000 BJ	
Benzenamine, 4-(1-methylethy	24.65			19 J	4900 J	
Unknown	25.04			18 J	4600 J	
Hexadecanoic Acid	25.17			340 J	87000 J	
9-Octadecenoic Acid	27.12			87 J	22000 J	
Octadecanoic Acid	27.27			44 J	11000 J	
Unknown Hexanedioic Acid Ester	29.42			89 BJ	23000 BJ	
Unknown Alkane	30.24			34 J	8700 J	
Unknown Alkane	31.16			30 J	7700 J	
Unknown	34.01			40 J	10000 J	
Unknown	34.37			500 J	130000 J	
Unknown	35.24			210 J	54000 J	
Unknown	46.68			550 J	140000 J	
Unknown	9.64	32 J	4800 J			
Unknown Alkane	10.97	36 J	5400 J			
Unknown Alkane	12.49	50 J	7600 J			
Unknown Alkane	12.84	41 J	6200 J			
Unknown	19.47	34 BJ	5200 BJ			
Pentadecane	19.74	32 J	4800 J			
Dodecanamide, N,N-bis(2-hydr	20.57	97 J	15000 J			

Appendix D. (Continued) - SRD, 1989.

Sample: Lab Log #: Date: Time:		Duvall Sludge 338415 8/16 1205		North Bend Sludge 338427 8/16 0845		Snoqualmie Sludge 368246 9/6 1545-1700
Compound	Retention Time					
BNA Scan		(μg/L)	(μg/Kg dry wt)	(μg/L)	(μg/Kg dry wt)	(μg/Kg dry wt)
Tetradecanoic Acid	23.12	680 J	100000 J			
Pentadecanoic Acid	24.24	84 J	13000 J			
Unknown Phthalate	24.37	110 BJ	17000 BJ			
Hexadecanoic Acid	25.24	2100 J	320000 J			
Hexadecanoic Acid (Isomer)	25.71	60 J	9100 J			
Unknown	27.32	460 J	70000 J			
Unknown	27.72	51 J	7700 J			
Unknown Hexanedioic Acid Ester	29.51	96 BJ	14000 BJ			
Unknown	34.09	160 J	14000 J			
Unknown	36.09	41 J	6200 J			
Unknown	39.86	150 J	23000 J			
Unknown	40.39	61 J	9200 J			
Unknown	40.86	91 J	14000 J			

J - indicates an estimated value.
B - This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.
BJ - B+J

APPENDIX E

Laboratory Procedure Review Sheet

Discharger: NORTH BEND

Date: 7/26

Discharger representative: Doug Repp

Ecology reviewer: Heffner

Instructions

Questionnaire for use reviewing laboratory procedures. Circled numbers indicate work is needed in that area to bring procedures into compliance with approved techniques. References are sited to help give guidance for making improvements. References sited include:

Ecology = Department of Ecology Laboratory User's Manual, December 8, 1986.

SM = APHA-AWWA-WPCF, Standard Methods for the Examination of Water and Wastewater, 16th ed., 1985.

SSM = WPCF, Simplified Laboratory Procedures for Wastewater Examination, 3rd ed., 1985.

Sample Collection Review

1. Are grab, hand composite, or automatic composite samples collected for influent and effluent BOD and TSS analysis?

2. If automatic compositor, what type of compositor is used? Manning
   The compositor should have pre and post purge cycles unless it is a flow through type. Check if you are unfamiliar with the type being used.

3. Are composite samples collected based on time or flow?

4. What is the usual day(s) of sample collection? Wed Thurs Fri

5. What time does sample collection usually begin? usual 8-10

6. How long does sample collection last? 24 hr

7. How often are subsamples that make up the composite collected? hourly

8. What volume is each subsample? 300 mL

9. What is the final volume of sample collected?

10. Is the composite cooled during collection? refrigerated

11. To what temperature? cool
The sample should be maintained at approximately 4 degrees C (SM p41, #5b: SSM p2).

12. How is the sample cooled?
Mechanical refrigeration or ice are acceptable. Blue ice or similar products are often inadequate.

13 How often is the temperature measured? don't check
The temperature should be checked at least monthly to assure adequate cooling.

14. Are the sampling locations representative? OK

15. Are any return lines located upstream of the influent sampling location? no
This should be avoided whenever possible.

16. How is the sample mixed prior to withdrawal of a subsample for analysis? OK
The sample should be thoroughly mixed.

17. How is the subsample stored prior to analysis? tested same day
The sample should be refrigerated (4 degrees C) until about 1 hour before analysis, at which time it is allowed to warm to room temperature.

18 What is the cleaning frequency of the collection jugs? rinse should wash occasionally
The jugs should be thoroughly rinsed after each sample is complete and occasionally be washed with a non-phospate detergent.

19 How often are the sampler lines cleaned? should do
Rinsing lines with a chlorine solution every three months or more often where necessary is suggested.

pH Test Review

1. How is the pH measured? daily
A meter should be used. Use of paper or a colorimetric test is inadequate and those procedures are not listed in Standard Methods (SM p429).

2. How often is the meter calibrated? resides in
The meter should be calibrated every day it is used.

3. What buffers are used for calibration? 7.0 should do 2 pt. use 7-10
Two buffers bracketing the pH of the sample being tested should be used.

If the meter can only be calibrated with one buffer, the buffer closest in pH to the sample should be used. A second buffer, which brackets the pH of the sample should be used as a check. If the meter cannot accurately determine the pH of the second buffer, the meter should be repaired.

BOD Test Review

1. What reference is used for the BOD test? Simplified - have 14th suggest get 17th
Standard Methods or the Ecology handout should be used.

2. How often are BODs run? 1x/week
The minimum frequency is specified in the permit.

3. How long after sample collection is the test begun? immediate
The test should begin within 24 hours of composite sample completion (Ecology Lab Users Manual p42). Starting the test as soon after samples are complete is desirable.

4. Is distilled or deionized water used for preparing dilution water?

5. Is the distilled water made with a copper free still? purchased
Copper stills can leave a copper residual in the water which can be toxic to the test (SSM p36).

6. Are any nitrification inhibitors used in the test? no What?
2-chloro-6(trichloro methyl) pyridine or Hach Nitrification Inhibitor 2533 may be used only if carbonaceous BODs are being determined (SM p 527, #4g: SSM p 37).

7. Are the 4 nutrient buffers of powder pillows used to make dilution water? fresh 2 or 3 x's/yr
If the nutrients are used, how much buffer per liter of dilution water are added?
1 mL per liter should be added (SM p527, #5a: SSM p37).

8. How often is the dilution water prepared? weekly
Dilution water should be made for each set of BODs run.

9. Is the dilution water aged prior to use? no
Dilution water with nitrification inhibitor can be aged for a week before use (SM p528, #5b).
Dilution water without inhibitor should not be aged.

10. Have any of the samples been frozen? no
If yes, are they seeded?
Samples that have been frozen should be seeded (SSM p38).

11. Is the pH of all samples between 6.5 and 7.5? ok
If no, is the sample pH adjusted?
The sample pH should be adjusted to between 6.5 and 7.5 with 1N NaOH or 1N H2SO4 if 6.5 > pH >7.5 if caustic alkalinity or acidity is present (SM p529, #5e1: SSM p37).
High pH from lagoons is usually not caustic. Place the sample in the dark to warm up, then check the pH to see if adjustment is necessary.

If the sample pH is adjusted, is the sample seeded?
The sample should be seeded to assure adequate microbial activity if the pH is adjusted (SM p528, #5d).

12. Have any of the samples been chlorinated or ozonated? no
If chlorinated are they checked for chlorine residual and dechlorinated as necessary?
How are they dechlorinated?
Samples should be dechlorinated with sodium sulfite (SM p528, #5e2: SSM p38), but dechlorination with sodium thiosulfate is common practice. Sodium thiosufate dechlorination is probably acceptable if the chlorine residual is < 1-2 mg/L.
If chlorinated or ozonated, is the sample seeded?
The sample should be seeded if it was disinfected (SM p528, #5d&5e2: SSM p38).

13. Do any samples have a toxic effect on the BOD test? no
Specific modifications are probably necessary (SM p528, #5d: SSM p37).

14. How are DO concentrations measured? YSI
If with a meter, how is the meter calibrated? air - 2x's/mth Winkler
Air calibration is adequate. Use of a barometer to determine saturation is desirable, although not manditory. Checks using the Winkler method of samples found to have a low DO are desirable to assure that the meter is accurate over the range of measurements being made.

How frequently is the meter calibrated? before use
The meter should be calibrated before use.

15. Is a dilution water blank run? yes
A dilution water blank should always be run for quality assurance (SM p527, #5b: SSM p40, #3).

What is the usual initial DO of the blank? 8.6
The DO should be near saturation; 7.8 mg/L @ 4000 ft, 9.0 mg/L @ sea level (SM p528, #5b). The distilled or deionized water used to make the dilution water may be aged in the dark at ~20 degrees C for a week with a cotton plug in the opening prior to use if low DO or excess blank depletion is a problem .

suggest store in dark

→ What is the usual 5 day blank depletion? 0.4-0.6   ≈½ time > 0.2
The depletion should be 0.2 mg/L or less. If the depletion is greater, the cause should be found (SM p527-8, #5b: SSM p41, #6).

16. How many dilutions are made for each sample? 2
At least two dilutions are recommended. The dilutions should be far enough apart to provide a good extended range (SM p530, #5f: SSM p41).

17. Are dilutions made by the liter method or in the bottle?
Either method is acceptable (SM p530, #5f).

18. How many bottles are made at each dilution? 2
How many bottles are incubated at each dilution? 1
When determining the DO using a meter only one bottle is necessary. The DO is measured, then the bottle is sealed and incubated (SM p530, #5f2)
When determining the DO using the Winkler method two bottles are necessary. The initial DO is found of one bottle and the other bottle is sealed and incubated (Ibid.).

18. Is the initial DO of each dilution measured? yes
What is the typical initial DO? ≈8.5
The initial DO of each dilution should be measured. It should approximate saturation (see #14).

20. What is considered the minimum acceptable DO depletion after 5 days? OK
What is the minimum DO that should be remaining after 5 days? pay attention to
The depletion should be at least 2.0 mg/L and at least 1.0 mg/L should be left after 5 days (SM p531, #6: SSM p41).

21. Are any samples seeded? no
Which?
What is the seed source?
Primary effluent or settled raw wastewater is the preferred seed. Secondary treated sources can be used for inhibited tests (SM p528, #5d: SSM p41).

How much seed is added to each sample?
Adequate seed should be used to cause a BOD uptake of 0.6 to 1.0 mg/L due to seed in the sample (SM p529, #5d).

How is the BOD of the seed determined?
Dilutions should be set up to allow the BOD of the seed to be determined just as the BOD of a sample is determined. This is called the seed control (SM p529, #5d: SSM p41).

22. What is the incubator temperature? 21
The incubator should be kept at 20 +/- 1 degree C (SM p531, #5i: SSM p40, #3).

How is incubator temperature monitored? ~~weekly~~ OK
A thermometer in a water bath should be kept in the incubator on the same shelf as the BODs are incubated.

How frequently is the temperature checked? weekly
The temperature should be checked daily during the test. A temperature log on the incubator door is recommended.

How often must the incubator temperature be adjusted? weekly
Adjustment should be infrequent. If frequent adjustments (every 2 weeks or more often) are required the incubator should be repaired.

Is the incubator dark during the test period? OK
Assure the switch that turns off the interior light is functioning.

23. Are water seals maintained on the bottles during incubation? yes
Water seals should be maintained to prevent leakage of air during the incubation period (SM p531, #5i: SSM p40, #4).

24. Is the method of calculation correct? OK

Check to assure that no correction is made for any DO depletion in the blank and that the seed correction is made using seed control data.

Standard Method calculations are (SM p531, #6):

for unseeded samples;

$$BOD\ (mg/L) = \frac{D1 - D2}{P}$$

for seeded samples;

$$BOD\ (mg/L) = \frac{(D1 - D2) - (B1 - B2)f}{P}$$

Where: D1 = DO of the diluted sample before incubation (mg/L)
D2 = DO of diluted sample after incubation period (mg/L)
P = decimal volumetric fraction of sample used
B1 = DO of seed control before incubation (mg/L)
B2 = DO of seed control after incubation (mg/L)

$$f = \frac{\text{amount of seed in bottle D1 (mL)}}{\text{amount of seed in bottle B1 (mL)}}$$

Total Suspended Solids Test Review

Preparation

1. What reference is used for the TSS test? Simplified Std Mthds

2. What type of filter paper is used?
   Std. Mthds. approved papers are: Whatman 934AH (Reeve Angel), Gelman A/E, and Millipore AP-40 (SM p95,footnote: SSM p23)

3. What is the drying oven temperature? turn on night before to stabalize
   The temperature should be 103-105 degrees C (SM p96, #3a: SSM p23).
   101 - should be

4. Are any volatile suspended solids tests run? yes mess
   If yes--What is the muffle furnance temperature? 500-550
   The temperature should be 550+/- 50 degrees C (SM p98, #3: SSM p23).

5. What type of filtering ~~apparatus is~~ used?
   Gooch crucibles or a membrane filter apparatus should be used (SM p95, #2b: SSM p23).

6. How are the filters pre-washed prior to use? should do
   The filters should be rinsed 3 times with distilled water (SM p23, #2: SSM p23, #2).

   Are the rough or smooth sides of the filters up? yes
   The rough side should be up (SM p96, #3a: SSM p23, #1)

   How long are the filters dried? one hour
   The filters should be dried for at least one hour in the oven. An additional 20 minutes of drying in the furnance is required if volatile solids are to be tested (Ibid).

   How are the filters stored prior to use?
   The filters should be stored in a deesicator (Ibid).

7. How is the effectiveness of the desicant checked? ok
   All or a portion of the desicant should have an indicator to assure effectiveness.

Test Procedure

should use graduated cylinder
Inf 50-150
Ef 300-600

8. In what is the test volume of sample measured?
   The sample should be measured with a wide tipped pipette or a graduated cylinder. use graduations on filter apparatus

9. Is the filter seated with distilled water? OK
   The filter should be seated with distilled water prior to the test to avoid leakage along the filter sides (SM p97, #3c).

10. Is the entire measured volume always filtered? remember
The entire volume should always be filtered to allow the measuring vessel to be properly rinsed (SM p97, #3c: SSM p24, #4).

11. What are the average and minimum volumes filtered?

	Volume Minimum	Volume Average
Influent		
Effluent		

12. How long does it take to filter the samples?

	Time
Influent	
Effluent	

13. How long is filtering attempted before deciding that a filter is clogged? 5 minutes
Prolonged filtering can cause high results due to dissolved solids being caught in the filter (SM p96, #1b). We usually advise a five minute filtering maximum.

14. What do you do when a filter becomes clogged? start over
The filter should be discarded and a smaller volume of sample should be used with a new filter.

15. How are the filter funnel and measuring device rinsed onto the filter following sample addition? ok
Rinse 3x's with approximately 10 mLs of distilled water each time (? ?).

16. How long is the sample dried? 1-2 hours
The sample should be dried at least one hour for the TSS test and 20 minutes for the volatile test (SM p97, #3c; p98, #3: SSM p24, #4). Excessive drying times (such as overnight) should be avoided.

17. Is the filter thoroughly cooled in a dessicator prior to weighing? ok
The filter must be cooled to avoid drafts due to thermal differences when weighing (SM p97, #3c: SSM p97 #3c).

18. How frequently is the drying cycle repeated to assure constant filter weight has ben reached (weight loss <0.5 mg or 4%, whichever is less: SM p97, #3c)? suggest
We recommend that this be done at least once every 2 months.

19. Do calculations appear reasonable? ok
Standard Methods calculation (SM p97, #3c).

$$\text{mg/L TSS} = \frac{(A - B) \times 1000}{\text{sample volume (mL)}}$$

where: A= weight of filter + dried residue (mg)
B= weight of filter (mg)

Fecal Coliform Test Review

1. Is the Membrane Filtration (MF) or Most Probable Number (MPN) technique used?
   This review is for the MF technique.

2. Are sterile techniques used? OK

3. How is equipment sterilizated? OK
   Items should be either purchased sterilized or be sterilized. Steam sterilization, 121 degrees C for 15 to 30 minutes (15 psi); dry heat, 1-2 hours at 170 degrees C; or ultraviolet light for 2-3 minutes can be used. See Standard Methods for instruclions for specific items (SSM p67-68).

4. How is sterilization preserved prior to item use? OK
   Wrapping the items in kraft paper or foil before they are sterilized protects them from contamination (Ibid.).

5. How are the following items sterilized?

	Purchased Sterile	Sterilized at Plant
Collection bottles		
Phosphate buffer		
Media		
Media pads		
Petri dishes		
Filter apparatus		
Filters		
Pipettes		
Measuring cylinder		
Used petri dishes		

6. How are samples dechlorinated at the time of collection? OK
   Sodium thiosulfate (1 mL of 1% solution per 120 mLs (4 ounces) of sample to be collected) should be added to the collection bottle prior to sterilization (SM p856, #2: SSM p68, sampling).

7. Is phosphate buffer made specifically for this test? yes
   Use phosphate buffer made specifically for this test. The phosphate buffer for the BOD test should not be used for the coliform test (SM p855, #12: SSM p66).

8. What kind of media is used? OK
   M-FC media should be used (SM p896, SSM p66).

9. Is the media mixed or purchased in ampoules?
   Ampoules are less expensive and more convient for under 50 tests per day (SSM p65, bottom).

10. How is the media stored?
    The media should be refrigerated (SM p897, #1a: SSM p66, #5).

11. How long is the media stored? ≈ 3 mths
Mixed media should be stored no longer than 96 hours (SM p897, #1a: SSM p66, #5). Ampoules will usually keep from 3-6 months -- read ampoule directions for specific instructions.

12. Is the work bench disinfected before and after testing? ok
This is a necessary sanitazation procedure (SM p831, #1f).

13. Are forceps dipped in alcohol and flamed prior to use? ok
Dipping in alcohol and flaming are necessary to sterilize the forceps (SM p889, #1: SSM p73, #4).

14. Is sample bottle thoroughly shaken before the test volume is removed? The sample should be mixed thoroughly (SSM p73, #5). yes

15. Are special procedures followed when less than 20 mLs of sample is to be filtered? 50 & 100 mls
10-30 mLs of sterile phosphate buffer should be put on the filter. The sample should be put into the buffer water and swirled, then the vacuum should be turned on. More even organism distribution is attained using this technique (SM p890, #5a: SSM P73, #5).

16. Are special procedures followed when less than 1 mL of sample is to be filtered?
Sample dilution is necessary prior to filtration when <1 mL is to be tested (SM p864, #2c: SSM p69).

17. Is the filter apparatus rinsed with phosphate buffer after sample filtration? ok
Three 20-30 mL rinses of the filter apparatus are recommended (SM p891, #5b: SSM p75, #7).

18. How soon after sample filtration is incubation begun? immediately
Incubation should begin within 20-30 minutes (SM p897, #2d: SSM p77, #10 note).

19. What is the incubation temperature? ok
44.5 +/- 0.2 degrees C (SM p897, #2d: SSM p75, #9).

20. How long are the filters incubated? ok
24 +/- 2 hours (Ibid.).

21. How soon after incubation is complete are the plate counts made? ok
The counts should be made within 20 minutes after incubation is complete to avoid colony color fading (SSM p77, FC).

22. What color colonies are counted? ok
The fecal coliform colonies vary from light to dark blue (SM p897, #2e: SSM p78).

23. What magnification is used for counting? ok
10-15 power magnification is recommended (SM p898, #2e: SSM p78).

24. How many colonies blue colonies are usually counted on a plate? OK
Valid plate counts are between 20 and 60 colonies (SM p897, #2a: SSM p78).

25. How many total colonies are usually on a plate? OK
The plate should have <200 total colonies to avoid inhabition due to crowding (SM p893, #6a: SSM p63, top).

26. When calculating results, how are plates with <20 or >60 colonies considered when plates exist with between 20 and 60 colonies? OK
In this case the plates with <20 or >60 colonies should not be used for calculations (SM p898, #3: SSM p78, C&R).

27. When calculating results how are results expressed if all plates have < 20 or > 60 colonies? OK
Results should be identified as estimated.
The exception is when water quality is good and <20 colonies grow. In this case the lower limit can be ignored (SM p893, #6a: SSM p78, C&R).

28. How are results calculated? OK
Standard Methods procedure is (SM p893, #6a: SSM p78):

$$\text{Fecal coliforms/100 mL} = \frac{\text{\# of fecal coliform colonies counted}}{\text{sample size (mL)}} \times 100$$

Laboratory Procedure Review Sheet

Discharger: Snoqualmie STP

Date: 9/6

Discharger representative: Dean Collins

Ecology reviewer: Heffner

Instructions

Questionnaire for use reviewing laboratory procedures. Circled numbers indicate work is needed in that area to bring procedures into compliance with approved techniques. References are sited to help give guidance for making improvements. References sited include:

Ecology - Department of Ecology Laboratory User's Manual, December 8, 1986.

SM - APHA-AWWA-WPCF, Standard Methods for the Examination of Water and Wastewater, 16th ed., 1985.

SSM = WPCF, Simplified Laboratory Procedures for Wastewater Examination, 3rd ed., 1985.

Sample Collection Review

1. Are grab, hand composite, or automatic composite samples collected for influent and effluent BOD and TSS analysis?

2. If automatic compositor, what type of compositor is used? Isco

   The compositor should have pre and post-purge cycles unless it is a flow through type. Check if you are unfamiliar with the type being used.

3. Are composite samples collected based on time or flow?

4. What is the usual day(s) of sample collection? every 2 weeks

5. What time does sample collection usually begin? start Tues - off Wed

6. How long does sample collection last? 24 hours

7. How often are subsamples that make up the composite collected? ½ hour

8. What volume is each subsample? ≥ 200 mls

9. What is the final volume of sample collected? ≈ 2 ½ gal

10. Is the composite cooled during collection? ice - not room for much

11. To what temperature? 20.6 - order smaller container

The sample should be maintained at approximately 4 degrees C (SM, p41, #5b: SSM, p2).

12. How is the sample cooled? ice

Mechanical refrigeration or ice are acceptable. Blue ice or similar products are often inadequate.

13. How often is the temperature measured? did today

The temperature should be checked at least monthly to assure adequate cooling.

14. Are the sampling locations representative? OK

15. Are any return lines located upstream of the influent sampling location? none

This should be avoided whenever possible.

16. How is the sample mixed prior to withdrawal of a subsample for analysis? OK

The sample should be thoroughly mixed.

17. How is the subsample stored prior to analysis? test right away

The sample should be refrigerated (4 degrees C) until about 1 hour before analysis, at which time it is allowed to warm to room temperature.

18. What is the cleaning frequency of the collection jugs? OK

The jugs should be thoroughly rinsed after each sample is complete and occasionally be washed with a non-phosphate detergent.

19. How often are the sampler lines cleaned? new - should consider every 6 or eight months due to low frequency of sampling

Rinsing lines with a chlorine solution every three months or more often where necessary is suggested.

pH Test Review

1. How is the pH measured? Orion

   A meter should be used. Use of paper or a colorimetric test is inadequate and those procedures are not listed in Standard Methods (SM, p429).

2. How often is the meter calibrated? 1x /week - keep in 7

   The meter should be calibrated every day it is used.

3. What buffers are used for calibration? pH 7 & 10

   Two buffers bracketing the pH of the sample being tested should be used.

   If the meter can only be calibrated with one buffer, the buffer closest in pH to the sample should be used. A second buffer, which brackets the pH of the sample should be used as a check. If the meter cannot accurately determine the pH of the second buffer, the meter should be repaired.

BOD Test Review

1. What reference is used for the BOD test? OK

   Standard Methods or the Ecology handout should be used.

2. How often are BODs run? every 2weeks

   The minimum frequency is specified in the permit.

3. How long after sample collection is the test begun? right away

   The test should begin within 24 hours of composite sample completion (Ecology Lab Users Manual, p42). Starting the test as soon after samples are complete is desirable.

4. Is distilled or deionized water used for preparing dilution water?

5. Is the distilled water made with a copper free still? purchase

   Copper stills can leave a copper residual in the water which can be toxic to the test (SSM, p36).

6. Are any nitrification inhibitors used in the test? no What?

   2-chloro-6(trichloro methyl) pyridine or Hach Nitrification Inhibitor 2533 may be used only if carbonaceous BODs are being determined (SM, p527, #4g: SSM, p37).

7. *Are the four* nutrient buffers of powder pillows used to make dilution water? buy chemical

If the nutrients are used, how much buffer per liter of dilution water are added? 1 mL/L strength

1 mL per liter should be added (SM, p527, #5a: SSM, p37).

8. How often is the dilution water prepared? for test

Dilution water should be made for each set of BODs run.

9. Is the dilution water aged prior to use? no

Dilution water with nitrification inhibitor can be aged for a week before use (SM, p528, #5b).

Dilution water without inhibitor should not be aged.

10. Have any of the samples been frozen? never

If yes, are they seeded?

Samples that have been frozen should be seeded (SSM, p38).

11. Is the pH of all samples between 6.5 and 7.5? check

If no, is the sample pH adjusted?

The sample pH should be adjusted to between 6.5 and 7.5 with 1N NaOH or 1N H2SO4 if 6.5 > pH >7.5 if caustic alkalinity or acidity is present (SM, p529, #5e1: SSM, p37).

High pH from lagoons is usually not caustic. Place the sample in the dark to warm up, then check the pH to see if adjustment is necessary.

If the sample pH is adjusted, is the sample seeded?

The sample should be seeded to assure adequate microbial activity if the pH is adjusted (SM, p528, #5d).

12. Have any of the samples been chlorinated or ozonated? final

If chlorinated are they checked for chlorine residual and dechlorinated as necessary? needs to check - plans to w/ Mike Miers

How are they dechlorinated?

Samples should be dechlorinated with sodium sulfite (SM, p529, #5e2: SSM p38), but dechlorination with sodium thiosulfate is common practice. Sodium thiosufate dechlorination is probably acceptable if the chlorine residual is < 1-2 mg/L.

If chlorinated or ozonated, is the sample seeded?

The sample should be seeded if it was disinfected (SM, p528, #5d&5e2: SSM, p38).

13. Do any samples have a toxic effect on the BOD test?

Specific modifications are probably necessary (SM, p528, #5d: SSM, p37).

14. How are DO concentrations measured? YSI meter

If with a meter, how is the meter calibrated? air

Air calibration is adequate. Use of a barometer to determine saturation is desirable, although not mandatory. Checks using the Winkler method of samples found to have a low DO are desirable to assure that the meter is accurate over the range of measurements being made.

How frequently is the meter calibrated? ~~Daily~~ before use

The meter should be calibrated before use.

15. Is a dilution water blank run? always

A dilution water blank should always be run for quality assurance (SM, p527, #5b: SSM, p40, #3).

What is the usual initial DO of the blank? 5-10

The DO should be near saturation; 7.8 mg/L @ 4000 ft, 9.0 mg/L @ sea level (SM, p528, #5b). The distilled or deionized water used to make the dilution water may be aged in the dark at ~20 degrees C for a week with a cotton plug in the opening prior to use if low DO or excess blank depletion is a problem.

What is the usual 5 day blank depletion? ?

The depletion should be 0.2 mg/L or less. If the depletion is greater, the cause should be found (SM, p527-8, #5b: SSM, p41, #6).

16. How many dilutions are made for each sample? 2 dilutions

At least two dilutions are recommended. The dilutions should be far enough apart to provide a good extended range (SM, p530, #5f: SSM, p41).

17. Are dilutions made by the liter method or in the bottle?

Either method is acceptable (SM, p530, #5f).

18. How many bottles are made at each dilution? 2

How many bottles are incubated at each dilution? 1

When determining the DO using a meter only one bottle is necessary. The DO is measured, then the bottle is sealed and incubated (SM, p530, #5f2).

When determining the DO using the Winkler method two bottles are necessary. The initial DO is found of one bottle and the other bottle is sealed and incubated (Ibid.).

19. Is the initial DO of each dilution measured? yes

What is the typical initial DO? variable

The initial DO of each dilution should be measured. It should approximate saturation (see #14).

20. What is considered the minimum acceptable DO depletion after five days? usually w/in range

What is the minimum DO that should be remaining after five days?

The depletion should be at least 2.0 mg/L and at least 1.0 mg/L should be left after five days (SM, p531, #6: SSM, p41).

21. Are any samples seeded? no - should do isn't sure how to

prior to last 5 months - effluent grab samples prior to chlorination

Which?

What is the seed source?

Primary effluent or settled raw wastewater is the preferred seed. Secondary treated sources can be used for inhibited tests (SM, p528, #5d: SSM, p41).

How much seed is added to each sample?

Adequate seed should be used to cause a BOD uptake of 0.6 to 1.0 mg/L due to seed in the sample (SM, p529, #5d).

How is the BOD of the seed determined?

Dilutions should be set up to allow the BOD of the seed to be determined just as the BOD of a sample is determined. This is called the seed control (SM, p529, #5d: SSM, p41).

22. What is the incubator temperature? 22° -

The incubator should be kept at 20 +/- 1 degree C (SM, p531, #5i: SSM, p40, #3).

How is incubator temperature monitored? - incubator can't keep ~~it~~ cool enough

A thermometer in a water bath should be kept in the incubator on the same shelf as the BODs are incubated.

How frequently is the temperature checked? should keep log

The temperature should be checked daily during the test. A temperature log on the incubator door is recommended.

How often must the incubator temperature be adjusted?

Adjustment should be infrequent. If frequent adjustments (every two weeks or more often) are required the incubator should be repaired.

Is the incubator dark during the test period?

Assure the switch that turns off the interior light is functioning.

23. Are water seals maintained on the bottles during incubation? ok

Water seals should be maintained to prevent leakage of air during the incubation period (SM, p531, #5i: SSM, p40, #4).

24. Is the method of calculation correct?

Check to assure that no correction is made for any DO depletion in the blank and that the seed correction is made using seed control data.

Standard Method calculations are (SM, p531, #6):

for unseeded samples;

$$\text{BOD (mg/L)} = \frac{D1 - D2}{P}$$

for seeded samples;

$$\text{BOD (mg/L)} = \frac{(D1 - D2) - (B1 - B2)f}{P}$$

Where:

D1 = DO of the diluted sample before incubation (mg/L)
D2 = DO of diluted sample after incubation period (mg/L)
P = decimal volumetric fraction of sample used
B1 = DO of seed control before incubation (mg/L)
B2 = DO of seed control after incubation (mg/L)

$$f = \frac{\text{amount of seed in bottle D1 (mL)}}{\text{amount of seed in bottle B1 (mL)}}$$

Total Suspended Solids Test Review

Preparation

1. What reference is used for the TSS test? 1976 Simplified Mthds

2. What type of filter paper is used?

   Std. Mthds. approved papers are: Whatman 934AH (Reeve Angel), Gelman A/E, and Millipore AP-40 (SM, p95, footnote: SSM, p23)

3. What is the drying oven temperature? 101 - ~~[illegible]~~

   The temperature should be 103-105 degrees C (SM, p96, #3a: SSM, p23).

4. Are any volatile suspended solids tests run? no

   If yes, what is the muffle furnace temperature?

   The temperature should be 550+/- 50 degrees C (SM, p98, #3: SSM, p23).

5. What type of filtering apparatus is used?

   Gooch crucibles or a membrane filter apparatus should be used (SM, p95, #2b: SSM, p23).

6. How are the filters pre-washed prior to use? no needs to prepare filters ~~for~~ before use

   The filters should be rinsed three times with distilled water (SM, p23, #2: SSM, p23, #2).

   Are the rough or smooth sides of the filters up?

   The rough side should be up (SM, p96, #3a: SSM, p23, #1)

   How long are the filters dried?

   The filters should be dried for at least one hour in the oven. An additional 20 minutes of drying in the furnace is required if volatile solids are to be tested (Ibid).

   How are the filters stored prior to use?

   The filters should be stored in a desiccator (Ibid).

7. How is the effectiveness of the desiccant checked? indicator

All or a portion of the desiccant should have an indicator to assure effectiveness.

Test Procedure

8. In what is the test volume of sample measured?

The sample should be measured with a wide tipped pipette or a graduated cylinder. inf ef

9. Is the filter seated with distilled water? should

The filter should be seated with distilled water prior to the test to avoid leakage along the filter sides (SM, p97, #3c).

10. Is the entire measured volume always filtered? OK

The entire volume should always be filtered to allow the measuring vessel to be properly rinsed (SM, p97, #3c: SSM, p24, #4).

11. What are the average and minimum volumes filtered?

	Volume	
	Minimum	Average
Influent		inf ef 40-60
Effluent		

12. How long does it take to filter the samples? OK

	Time
Influent	
Effluent	

13. How long is filtering attempted before deciding that a filter is clogged? not problem

Prolonged filtering can cause high results due to dissolved solids being caught in the filter (SM, p96, #1b). We usually advise a five minute filtering maximum.

14. What do you do when a filter becomes clogged?

The filter should be discarded and a smaller volume of sample should be used with a new filter.

15. How are the filter funnel no and measuring yes device rinsed onto the filter following sample addition? OK

Rinse 3x's with approximately 10 mLs of distilled water each time (?   ?).

16. How long is the sample dried? 1 hour

The sample should be dried at least one hour for the TSS test and 20 minutes for the volatile test (SM, p97, #3c; p98, #3: SSM, p24, #4). Excessive drying times (such as overnight) should be avoided.

17. Is the filter thoroughly cooled in a desiccator prior to weighing? 1/2 hour

The filter must be cooled to avoid drafts due to thermal differences when weighing (SM, p97, #3c: SSM, p97 #3c).

18. How frequently is the drying cycle repeated to assure constant filter weight has been reached (weight loss <0.5 mg or 4 percent, whichever is less: SM, p97, #3c)?

We recommend that this be done at least once every two months.

19. Do calculations appear reasonable?

Standard Methods calculation (SM, p97, #3c).

$$\text{mg/L TSS} = \frac{(A - B) \times 1000}{\text{sample volume (mL)}}$$

where: A- weight of filter + dried residue (mg)
B- weight of filter (mg)

Fecal Coliform Test Review

1. Is the Membrane Filtration (MF) or Most Probable Number (MPN) technique used?

This review is for the MF technique.

2. Are sterile techniques used?

3. How is equipment sterilized? purchase

Items should be either purchased sterilized or be sterilized. Steam sterilization, 121 degrees C for 15 to 30 minutes (15 psi); dry heat, 1-2 hours at 170 degrees C; or ultraviolet light for 2-3 minutes can be used. See Standard Methods for instructions for specific items (SSM, p67-68).

12. Is the work bench disinfected before and after testing?

    This is a necessary sanitization procedure (SM, p831, #1f).

13. Are forceps dipped in alcohol and flamed prior to use?

    Dipping in alcohol and flaming are necessary to sterilize the forceps (SM, p889, #1: SSM p73, #4).

14. Is sample bottle thoroughly shaken before the test volume is removed?

    The sample should be mixed thoroughly (SSM, p73, #5).

15. Are special procedures followed when less than 20 mLs of sample is to be filtered?

    10-30 mLs of sterile phosphate buffer should be put on the filter. The sample should be put into the buffer water and swirled, then the vacuum should be turned on. More even organism distribution is attained using this technique (SM, p890, #5a: SSM P73, #5).

16. Are special procedures followed when less than 1 mL of sample is to be filtered?

    Sample dilution is necessary prior to filtration when <1 mL is to be tested (SM, p864, #2c: SSM p69).

17. Is the filter apparatus rinsed with phosphate buffer after sample filtration?

    Three 20-30 mL rinses of the filter apparatus are recommended (SM, p891, #5b: SSM, p75, #7).

18. How soon after sample filtration is incubation begun?

    Incubation should begin within 20-30 minutes (SM, p897, #2d: SSM p77, #10 note).

19. What is the incubation temperature?

    44.5 +/- 0.2 degrees C (SM, p897, #2d: SSM, p75, #9).

20. How long are the filters incubated?

    24 +/- 2 hours (Ibid.).

21. How soon after incubation is complete are the plate counts made?

    The counts should be made within 20 minutes after incubation is complete to avoid colony color fading (SSM, p77, FC).

22. What color colonies are counted?

    The fecal coliform colonies vary from light to dark blue (SM, p897, #2e: SSM, p78).

23. What magnification is used for counting?

    10-15 power magnification is recommended (SM, p898, #2e: SSM, p78).

24. How many colonies blue colonies are usually counted on a plate?

    Valid plate counts are between 20 and 60 colonies (SM, p897, #2a: SSM, p78).

25. How many total colonies are usually on a plate?

    The plate should have <200 total colonies to avoid inhibition due to crowding (SM, p893, #6a: SSM, p63, top).

26. When calculating results, how are plates with <20 or >60 colonies considered when plates exist with between 20 and 60 colonies?

    In this case the plates with <20 or >60 colonies should not be used for calculations (SM, p898, #3: SSM, p78, C&R).

27. When calculating results how are results expressed if all plates have < 20 or > 60 colonies?

    Results should be identified as estimated.

    The exception is when water quality is good and <20 colonies grow. In this case the lower limit can be ignored (SM, p893, #6a: SSM, p78, C&R).

28. How are results calculated?

    Standard Methods procedure is (SM, p893, #6a: SSM, p79):

$$\text{Fecal coliforms/100 mL} = \frac{\text{\# of fecal coliform colonies counted}}{\text{sample size (mL)}} \times 100$$

Laboratory Procedure Review Sheet

Discharger: Duvall

Date: 9/6/89

Discharger representative: John Light - started operating 3-4 weeks ago

Ecology reviewer: Heffner

Instructions

Questionnaire for use reviewing laboratory procedures. Circled numbers indicate work is needed in that area to bring procedures into compliance with approved techniques. References are sited to help give guidance for making improvements. References sited include:

Ecology - Department of Ecology Laboratory User's Manual, December 8, 1986.

SM - APHA-AWWA-WPCF, Standard Methods for the Examination of Water and Wastewater, 16th ed., 1985.

SSM - WPCF, Simplified Laboratory Procedures for Wastewater Examination, 3rd ed., 1985.

Sample Collection Review

1. Are grab, hand composite, or automatic composite samples collected for influent and effluent BOD and TSS analysis?

2. If automatic compositor, what type of compositor is used? Manning (portable)

   The compositor should have pre and post-purge cycles unless it is a flow through type. Check if you are unfamiliar with the type being used.

3. Are composite samples collected based on time or flow?

4. What is the usual day(s) of sample collection?

5. What time does sample collection usually begin? start Tues - end Wed

6. How long does sample collection last? 24

7. How often are subsamples that make up the composite collected? 1/hr

8. What volume is each subsample? ≈ 300 mls

9. What is the final volume of sample collected? 3-5 gallons

10. Is the composite cooled during collection? ice

11. To what temperature? should check

The sample should be maintained at approximately 4 degrees C (SM, p41, #5b: SSM, p2).

12. How is the sample cooled? ice

Mechanical refrigeration or ice are acceptable. Blue ice or similar products are often inadequate.

13. How often is the temperature measured? check

The temperature should be checked at least monthly to assure adequate cooling.

14. Are the sampling locations representative? OK

15. Are any return lines located upstream of the influent sampling location? no

This should be avoided whenever possible.

16. How is the sample mixed prior to withdrawal of a subsample for analysis? OK

The sample should be thoroughly mixed.

17. How is the subsample stored prior to analysis? set-up right away

The sample should be refrigerated (4 degrees C) until about 1 hour before analysis, at which time it is allowed to warm to room temperature.

18. What is the cleaning frequency of the collection jugs? alconox

The jugs should be thoroughly rinsed after each sample is complete and occasionally be washed with a non-phosphate detergent.

19. How often are the sampler lines cleaned? OK

Rinsing lines with a chlorine solution every three months or more often where necessary is suggested.

pH Test Review

1. How is the pH measured? meter

   A meter should be used. Use of paper or a colorimetric test is inadequate and those procedures are not listed in Standard Methods (SM, p429).

2. How often is the meter calibrated? every 2 weeks - suggest more frequent

   The meter should be calibrated every day it is used.

3. What buffers are used for calibration? 4 & 7 suggest 10 buffer next time

   Two buffers bracketing the pH of the sample being tested should be used.

   If the meter can only be calibrated with one buffer, the buffer closest in pH to the sample should be used. A second buffer, which brackets the pH of the sample should be used as a check. If the meter cannot accurately determine the pH of the second buffer, the meter should be repaired.

BOD Test Review

1. What reference is used for the BOD test? Eco handouts - Std Mthds

   Standard Methods or the Ecology handout should be used.

2. How often are BODs run? 1/wk

   The minimum frequency is specified in the permit.

3. How long after sample collection is the test begun? immediately

   The test should begin within 24 hours of composite sample completion (Ecology Lab Users Manual, p42). Starting the test as soon after samples are complete is desirable.

4. Is distilled or deionized water used for preparing dilution water?
   purchase distilled water

5. Is the distilled water made with a copper free still?

   Copper stills can leave a copper residual in the water which can be toxic to the test (SSM, p36).

6. Are any nitrification inhibitors used in the test? no What?

   2-chloro-6(trichloro methyl) pyridine or Hach Nitrification Inhibitor 2533 may be used only if carbonaceous BODs are being

7. Are the four nutrient buffers of powder pillows used to make dilution water? purchased

   If the nutrients are used, how much buffer per liter of dilution water are added?

   1 mL per liter should be added (SM, p527, #5a: SSM, p37).

8. How often is the dilution water prepared? OK

   Dilution water should be made for each set of BODs run.

9. Is the dilution water aged prior to use? no

   Dilution water with nitrification inhibitor can be aged for a week before use (SM, p528, #5b).

   Dilution water without inhibitor should not be aged.

10. Have any of the samples been frozen? no

    If yes, are they seeded?

    Samples that have been frozen should be seeded (SSM, p38).

11. Is the pH of all samples between 6.5 and 7.5? OK

    If no, is the sample pH adjusted?

    The sample pH should be adjusted to between 6.5 and 7.5 with 1N NaOH or 1N H2SO4 if 6.5 > pH >7.5 if caustic alkalinity or acidity is present (SM, p529, #5e1: SSM, p37).

    High pH from lagoons is usually not caustic. Place the sample in the dark to warm up, then check the pH to see if adjustment is necessary.

    If the sample pH is adjusted, is the sample seeded?

    The sample should be seeded to assure adequate microbial activity if the pH is adjusted (SM, p528, #5d).

12. Have any of the samples been chlorinated or ozonated? final effluent

    If chlorinated are they checked for chlorine residual and dechlorinated as necessary? yes

    How are they dechlorinated? no residual in comp.

Samples should be dechlorinated with sodium sulfite (SM, p529, #5e2: SSM p38), but dechlorination with sodium thiosulfate is common practice. Sodium thiosufate dechlorination is probably acceptable if the chlorine residual is < 1-2 mg/L.

If chlorinated or ozonated, is the sample seeded? yes

The sample should be seeded if it was disinfected (SM, p528, #5d&5e2: SSM, p38).

13. Do any samples have a toxic effect on the BOD test? probably not

Specific modifications are probably necessary (SM, p528, #5d: SSM, p37).

14. How are DO concentrations measured? winkler w/ PAO

If with a meter, how is the meter calibrated?

Air calibration is adequate. Use of a barometer to determine saturation is desirable, although not mandatory. Checks using the Winkler method of samples found to have a low DO are desirable to assure that the meter is accurate over the range of measurements being made.

How frequently is the meter calibrated?

The meter should be calibrated before use.

15. Is a dilution water blank run? yes

A dilution water blank should always be run for quality assurance (SM, p527, #5b: SSM, p40, #3).

What is the usual initial DO of the blank? ≈ 8.3

The DO should be near saturation; 7.8 mg/L @ 4000 ft, 9.0 mg/L @ sea level (SM, p528, #5b). The distilled or deionized water used to make the dilution water may be aged in the dark at ~20 degrees C for a week with a cotton plug in the opening prior to use if low DO or excess blank depletion is a problem.

What is the usual 5 day blank depletion? ≈ 0.2

The depletion should be 0.2 mg/L or less. If the depletion is greater, the cause should be found (SM, p527-8, #5b: SSM, p41, #6).

16. How many dilutions are made for each sample? 2

At least two dilutions are recommended. The dilutions should be far enough apart to provide a good extended range (SM, p530, #5f:

17. Are dilutions made by the liter method or in the bottle?

Either method is acceptable (SM, p530, #5f).

18. How many bottles are made at each dilution? 3

How many bottles are incubated at each dilution? 2

When determining the DO using a meter only one bottle is necessary. The DO is measured, then the bottle is sealed and incubated (SM, p530, #5f2).

When determining the DO using the Winkler method two bottles are necessary. The initial DO is found of one bottle and the other bottle is sealed and incubated (Ibid.).

19. Is the initial DO of each dilution measured? yes

What is the typical initial DO? ≈ 8-8.5

The initial DO of each dilution should be measured. It should approximate saturation (see #14).

20. What is considered the minimum acceptable DO depletion after five days? needs to remember

What is the minimum DO that should be remaining after five days?

The depletion should be at least 2.0 mg/L and at least 1.0 mg/L should be left after five days (SM, p531, #6: SSM, p41).

21. Are any samples seeded? yes

Which? inf - ef

What is the seed source? unchlorinated secondary

Primary effluent or settled raw wastewater is the preferred seed. Secondary treated sources can be used for inhibited tests (SM, p528, #5d: SSM, p41).

How much seed is added to each sample? still experimenting

Adequate seed should be used to cause a BOD uptake of 0.6 to 1.0 mg/L due to seed in the sample (SM, p529, #5d).

How is the BOD of the seed determined? seed control

Dilutions should be set up to allow the BOD of the seed to be determined just as the BOD of a sample is determined. This is called the seed control (SM, p529, #5d: SSM, p41).

22. What is the incubator temperature? 20°

The incubator should be kept at 20 +/- 1 degree C (SM, p531, #5i: SSM, p40, #3).

How is incubator temperature monitored? thermometer

suggest

A thermometer in a water bath should be kept in the incubator on the same shelf as the BODs are incubated.

How frequently is the temperature checked? when put in when should check/out also

The temperature should be checked daily during the test. A temperature log on the incubator door is recommended.

How often must the incubator temperature be adjusted? seldom

Adjustment should be infrequent. If frequent adjustments (every two weeks or more often) are required the incubator should be repaired.

Is the incubator dark during the test period? OK

Assure the switch that turns off the interior light is functioning.

23. Are water seals maintained on the bottles during incubation?

Water seals should be maintained to prevent leakage of air during the incubation period (SM, p531, #5i: SSM, p40, #4).

24. Is the method of calculation correct? - recheck seed correction calc

Check to assure that no correction is made for any DO depletion in the blank and that the seed correction is made using seed control data.

Standard Method calculations are (SM, p531, #6):

for unseeded samples;

$$\text{BOD (mg/L)} = \frac{D1 - D2}{P}$$

for seeded samples;

$$\text{BOD (mg/L)} = \frac{(D1 - D2) - (B1 - B2)f}{P}$$

Where:

- D1 = DO of the diluted sample before incubation (mg/L)
- D2 = DO of diluted sample after incubation period (mg/L)
- P = decimal volumetric fraction of sample used
- B1 = DO of seed control before incubation (mg/L)

$$f = \frac{\text{amount of seed in bottle D1 (mL)}}{\text{amount of seed in bottle B1 (mL)}}$$

Total Suspended Solids Test Review

Preparation

1. What reference is used for the TSS test? Ecology & Std Mthds

2. What type of filter paper is used?

   Std. Mthds. approved papers are: Whatman 934AH (Reeve Angel), Gelman A/E, and Millipore AP-40 (SM, p95, footnote: SSM, p23)

3. What is the drying oven temperature? 105

   The temperature should be 103-105 degrees C (SM, p96, #3a: SSM, p23).

4. Are any volatile suspended solids tests run? MLSS

   If yes, what is the muffle furnace temperature? 550

   The temperature should be 550+/- 50 degrees C (SM, p98, #3: SSM, p23).

5. What type of filtering apparatus is used?

   Gooch crucibles or a membrane filter apparatus should be used (SM, p95, #2b: SSM, p23).

6. How are the filters pre-washed prior to use? OK

   The filters should be rinsed three times with distilled water (SM, p23, #2: SSM, p23, #2).

   Are the rough or smooth sides of the filters up? OK

   The rough side should be up (SM, p96, #3a: SSM, p23, #1)

   How long are the filters dried? ≥1 hr

   The filters should be dried for at least one hour in the oven. An additional 20 minutes of drying in the furnace is required if volatile solids are to be tested (Ibid).

   How are the filters stored prior to use? dessicator

   The filters should be stored in a desiccator (Ibid).

7. How is the effectiveness of the desiccant checked? indicator

All or a portion of the desiccant should have an indicator to assure effectiveness.

Test Procedure

8. In what is the test volume of sample measured? 50 mls - graduated cylinder

The sample should be measured with a wide tipped pipette or a graduated cylinder.

9. Is the filter seated with distilled water? OK

The filter should be seated with distilled water prior to the test to avoid leakage along the filter sides (SM, p97, #3c).

10. Is the entire measured volume always filtered? OK

The entire volume should always be filtered to allow the measuring vessel to be properly rinsed (SM, p97, #3c: SSM, p24, #4).

11. What are the average and minimum volumes filtered?

50 mls

	Volume	
	Minimum	Average
Influent		
Effluent		

12. How long does it take to filter the samples? ≈ 30 ~~samples~~ seconds

	Time
Influent	
Effluent	

13. How long is filtering attempted before deciding that a filter is clogged? not long

Prolonged filtering can cause high results due to dissolved solids being caught in the filter (SM, p96, #1b). We usually advise a five minute filtering maximum.

14. What do you do when a filter becomes clogged? pitch

The filter should be discarded and a smaller volume of sample should be used with a new filter.

15. How are the filter funnel and measuring device rinsed onto the filter following sample addition? OK

Rinse 3x's with approximately 10 mLs of distilled water each time (? ?).

16. How long is the sample dried? 1 hr +

The sample should be dried at least one hour for the TSS test and 20 minutes for the volatile test (SM, p97, #3c; p98, #3: SSM, p24, #4). Excessive drying times (such as overnight) should be avoided.

17. Is the filter thoroughly cooled in a desiccator prior to weighing? OK

The filter must be cooled to avoid drafts due to thermal differences when weighing (SM, p97, #3c: SSM, p97 #3c).

18. How frequently is the drying cycle repeated to assure constant filter weight has been reached (weight loss <0.5 mg or 4 percent, whichever is less: SM, p97, #3c)? does occassionally

We recommend that this be done at least once every two months.

19. Do calculations appear reasonable? OK

Standard Methods calculation (SM, p97, #3c).

$$\text{mg/L TSS} = \frac{(A - B) \times 1000}{\text{sample volume (mL)}}$$

where: A- weight of filter + dried residue (mg)
B- weight of filter (mg)

Fecal Coliform Test Review

1. Is the Membrane Filtration (MF) or Most Probable Number (MPN) technique used?

This review is for the MF technique.

2. Are sterile techniques used? OK

3. How is equipment sterilized? purchase or autoclave

Items should be either purchased sterilized or be sterilized. Steam sterilization, 121 degrees C for 15 to 30 minutes (15 psi); dry heat, 1-2 hours at 170 degrees C; or ultraviolet light for 2-3 minutes can be used. See Standard Methods for instructions for specific items (SSM, p67-68).

4. How is sterilization preserved prior to item use? foil

Wrapping the items in kraft paper or foil before they are sterilized protects them from contamination (Ibid.).

5. How are the following items sterilized?

	Purchased Sterile	Sterilized at Plant
Collection bottles		
Phosphate buffer		
Media		
Media pads		
Petri dishes		
Filter apparatus		
Filters		
Pipettes		
Measuring cylinder		
Used petri dishes		

6. How are samples dechlorinated at the time of collection? ok - will add more this due to larger bottle size

Sodium thiosulfate (1 mL of 1% solution per 120 mLs (4 ounces) of sample to be collected) should be added to the collection bottle prior to sterilization (SM p856, #2: SSM p68, sampling).

7. Is phosphate buffer made specifically for this test? yes

Use phosphate buffer made specifically for this test. The phosphate buffer for the BOD test should not be used for the coliform test (SM, p855, #12: SSM p66).

8. What kind of media is used? ok

M-FC media should be used (SM, p896, SSM p66).

9. Is the media mixed or purchased in ampoules? purchase

Ampoules are less expensive and more convenient for under 50 tests per day (SSM, p65, bottom).

10. How is the media stored? refrigerate

The media should be refrigerated (SM, p897, #1a: SSM p66, #5).

11. How long is the media stored? ok

Mixed media should be stored no longer than 96 hours (SM, p897, #1a: SSM, p66, #5). Ampoules will usually keep from three to six months -- read ampoule directions for specific instructions.

12. Is the work bench disinfected before and after testing? OK

This is a necessary sanitization procedure (SM, p831, #1f).

13. Are forceps dipped in alcohol and flamed prior to use? OK

Dipping in alcohol and flaming are necessary to sterilize the forceps (SM, p889, #1: SSM p73, #4).

14. Is sample bottle thoroughly shaken before the test volume is removed? OK

The sample should be mixed thoroughly (SSM, p73, #5).

15. Are special procedures followed when less than 20 mLs of sample is to be filtered? OK - always dilute to 100 mls before testing

10-30 mLs of sterile phosphate buffer should be put on the filter. The sample should be put into the buffer water and swirled, then the vacuum should be turned on. More even organism distribution is attained using this technique (SM, p890, #5a: SSM P73, #5).

16. Are special procedures followed when less than 1 mL of sample is to be filtered? ~~OK~~ not done

Sample dilution is necessary prior to filtration when <1 mL is to be tested (SM, p864, #2c: SSM p69).

17. Is the filter apparatus rinsed with phosphate buffer after sample filtration? OK

Three 20-30 mL rinses of the filter apparatus are recommended (SM, p891, #5b: SSM, p75, #7).

18. How soon after sample filtration is incubation begun? OK

Incubation should begin within 20-30 minutes (SM, p897, #2d: SSM p77, #10 note).

19. What is the incubation temperature? 44.5

44.5 +/- 0.2 degrees C (SM, p897, #2d: SSM, p75, #9).

20. How long are the filters incubated? OK

24 +/- 2 hours (Ibid.).

21. How soon after incubation is complete are the plate counts made? OK

The counts should be made within 20 minutes after incubation is complete to avoid colony color fading (SSM, p77, FC).

22. What color colonies are counted? blue

The fecal coliform colonies vary from light to dark blue (SM, p897, #2e: SSM, p78).

23. What magnification is used for counting? no

10-15 power magnification is recommended (SM, p898, #2e: SSM, p78).

24. How many colonies blue colonies are usually counted on a plate? knows

Valid plate counts are between 20 and 60 colonies (SM, p897, #2a: SSM, p78).

25. How many total colonies are usually on a plate? ok

The plate should have <200 total colonies to avoid inhibition due to crowding (SM, p893, #6a: SSM, p63, top).

26. When calculating results, how are plates with <20 or >60 colonies considered when plates exist with between 20 and 60 colonies? ok

In this case the plates with <20 or >60 colonies should not be used for calculations (SM, p898, #3: SSM, p78, C&R).

27. When calculating results how are results expressed if all plates have < 20 or > 60 colonies? ok

Results should be identified as estimated.

The exception is when water quality is good and <20 colonies grow. In this case the lower limit can be ignored (SM, p893, #6a: SSM, p78, C&R).

28. How are results calculated? ok

Standard Methods procedure is (SM, p893, #6a: SSM, p79):

$$\text{Fecal coliforms/100 mL} = \frac{\text{\# of fecal coliform colonies counted}}{\text{sample size (mL)}} \times 100$$